WATER RESOURCES AUTHORITY
MASSACHUSETTS

Secondary Treatment Facilities Plan

Early Site Preparation

Volume VI

DRAFT REPORT

September 16, 1987

Secondary Treatment Facilities Plan

Early Site Preparation

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NOTICE TO REVIEWERS

Attached for your review is the draft report of Volume VI, Early Site Preparation of the Secondary Treatment Facilities Plan.

This document has received MWRA staff review and the Recommended Plan has been endorsed by the MWRA Board of Directors for release for public comment. The draft report is being circulated at this time for review and comments by interested parties. Comments received will be submitted to the Board of Directors following the review period and prior to their final acceptance.

Information in this report is current as of September 16, 1987.

Daniel K. O'Brien
Acting Director
Engineering Division
September 16, 1987

HOW TO USE THE SECONDARY TREATMENT FACILITIES PLAN

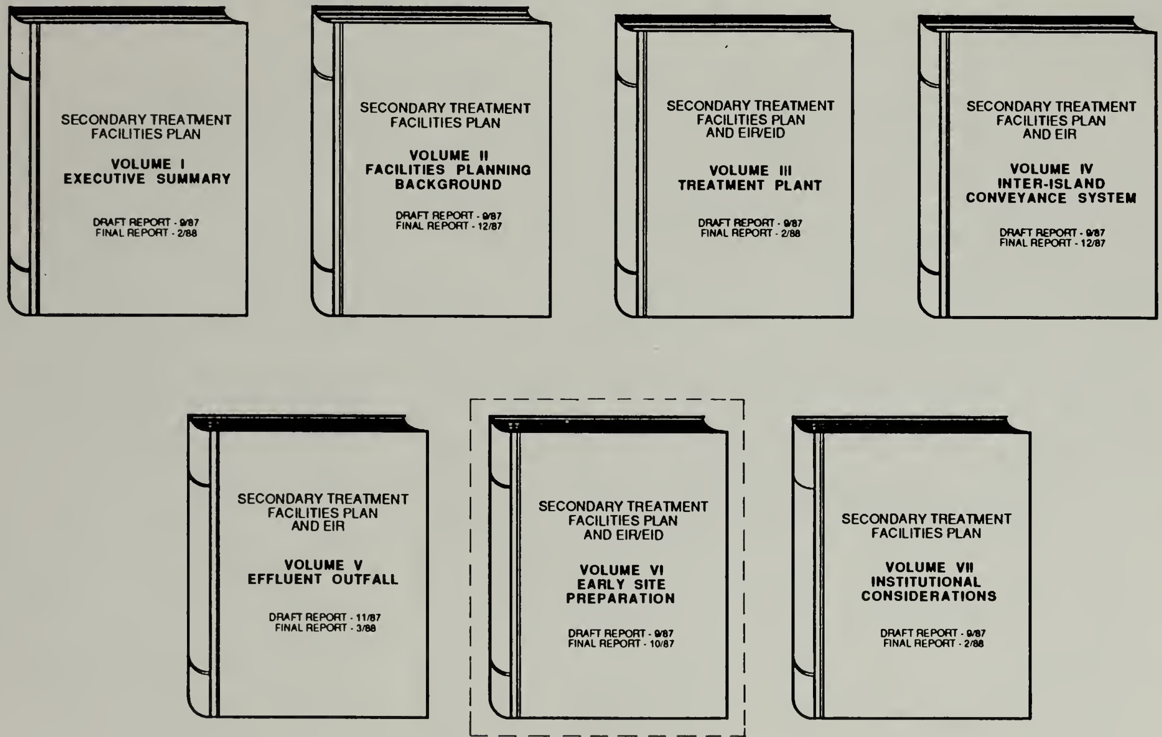
The Secondary Treatment Facilities Plan is organized into seven volumes.

The major components of the Secondary Treatment Facilities Plan are: Treatment Plant, Inter-Island Conveyance, Effluent Outfall, and Early Site Preparation.

The Secondary Treatment Facilities Plan document consists of a stand-alone volume for each of these components as well as volumes for Facilities Planning Background, Institutional Considerations, and Executive Summary.

Each volume may be referenced to find complete planning information pursuant to that project component. The seven volumes are numbered as follows:

Volume I	Executive Summary
Volume II	Facilities Planning Background
Volume III	Treatment Plant
Volume IV	Inter-Island Conveyance System
Volume V	Effluent Outfall
Volume VI	Early Site Preparation
Volume VII	Institutional Considerations



MASSACHUSETTS
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AUTHORITY

DEER ISLAND
SECONDARY TREATMENT FACILITIES PLAN
VOLUMES

Table of Contents

SECONDARY TREATMENT FACILITIES PLAN

VOLUME VI

Table of Contents

SECONDARY TREATMENT FACILITIES PLAN
Volume VI
Early Site Preparation

List of Tables

SECONDARY TREATMENT FACILITIES PLAN
Volume VI
Early Site Preparation

List of Tables
(continued)

SECONDARY TREATMENT FACILITIES PLAN
Volume VI
Early Site Preparation

List of Tables
(continued)

SECONDARY TREATMENT FACILITIES PLAN
Volume VI
Early Site Preparation

List of Figures

SECONDARY TREATMENT FACILITIES PLAN
Volume VI
Early Site Preparation

List of Figures
(continued)

SECONDARY TREATMENT FACILITIES PLAN
Volume VI
Early Site Preparation

List of Figures
(continued)

Section 1

1.0 SUMMARY

1.1 VOLUME IDENTIFICATION

This is Volume VI, Early Site Preparation, Secondary Treatment Facilities Plan, one of seven volumes that make up the entire plan.

1.2 INTRODUCTION

The Early Site Preparation phase of the Secondary Treatment Facilities project consists of those construction activities which can be initiated at an early date to prepare Deer Island for the late 1990 start of construction of the new treatment facilities.

The major activities of this phase of the project include protection of the existing plant outfall pipes followed by the on-site relocation of existing grit and screenings to a secured landfill, the excavation of a sizeable segment of the central drumlin, and the creation of visual and noise barrier landforms. Demolition of the existing water reservoir atop the central drumlin and of the Fort Dawes structures will also be accomplished.

Environmental impacts will be mitigated by various noise, visual, odor, traffic, and land-use restrictions. Costs and schedule will be optimized by adherence to the recommended plan.

1.3 DESCRIPTION OF RECOMMENDED PLAN

The recommended plan for Early Site Preparation includes:

- Installation of additional protection of the existing outfall pipes.
- On-site relocation and disposal of 85,000 yd^3 of existing grit and screenings.
- Excavation, hauling, and placing of approximately 1,600,000 yd^3 of drumlin soils to various on-site locations.
- Demolition of Fort Dawes and the water reservoir atop the drumlin.
- Provision of a back-up, non-potable service water system to the existing plant.
- Any required relocation of island land access facilities (i.e. roadways, parking lot and security station and fencing).
- Preparation of the area of the site for the concrete batch plant.

Since the on-island piers will not be operational until late 1989, the inability to remove and

dispose of excavated drumlin soils from the area which will be needed for new primary plant construction is a constraint that is best circumvented by the use of existing prison property. The existing Deer Island site layout is shown in Figure 1.3-1.

The recommended plan, shown in Figure 1.3-2, is based on obtaining complete access to the Deer Island House of Correction property by 1989. Appendix F contains the legislation, enacted by the Commonwealth of Massachusetts in 1986, that requires the prison facility to be decommissioned by 1989. Access to prison property allows the creation of permanent noise and visual barrier landforms which are preferable to the phased construction of barriers that will have to occur if prison property access is unavailable. Complete prison property access also eliminates the need to implement special costly mitigation measures that may be required to minimize the impacts of construction on the inhabitants of the prison.

Disposal of the existing Deer Island grit and screenings in a secure landfill at the southern tip of the island is another important aspect of the recommended plan. This disposal alternative will meet the Massachusetts Department of Environmental Quality Engineering (DEQE) requirements for a sludge-only landfill at a lower cost and with less environmental impact than a chemical stabilization alternative.

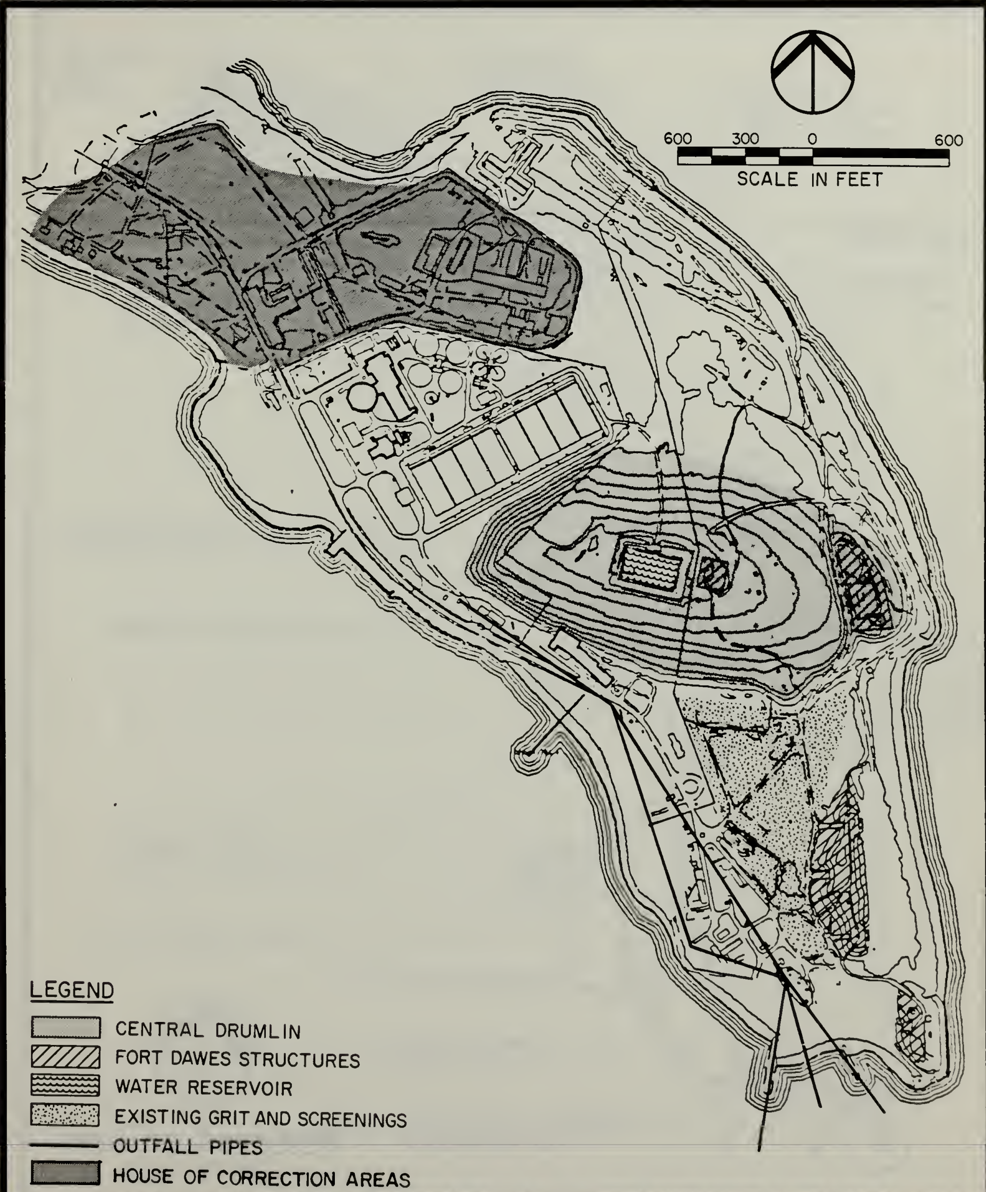
1.3.1 COSTS

The estimated cost of the recommended plan for early site preparation work is $17.4 million. This estimate includes the costs of: (1) the installation of additional protection for the existing outfall pipes; (2) on-site relocation and disposal of 85,000 yd^3 of existing grit and screenings; (3) excavation, hauling and placing of 1.6 million yd^3 of drumlin soils to various on-site locations; (4) modifications required to provide a back-up service water supply; (5) demolition of Fort Dawes and the water reservoir atop the drumlin; and (6) relocation of the island access and security facilities.

1.3.2 ENVIRONMENTAL IMPACT ASSESSMENT AND MITIGATION MEASURES

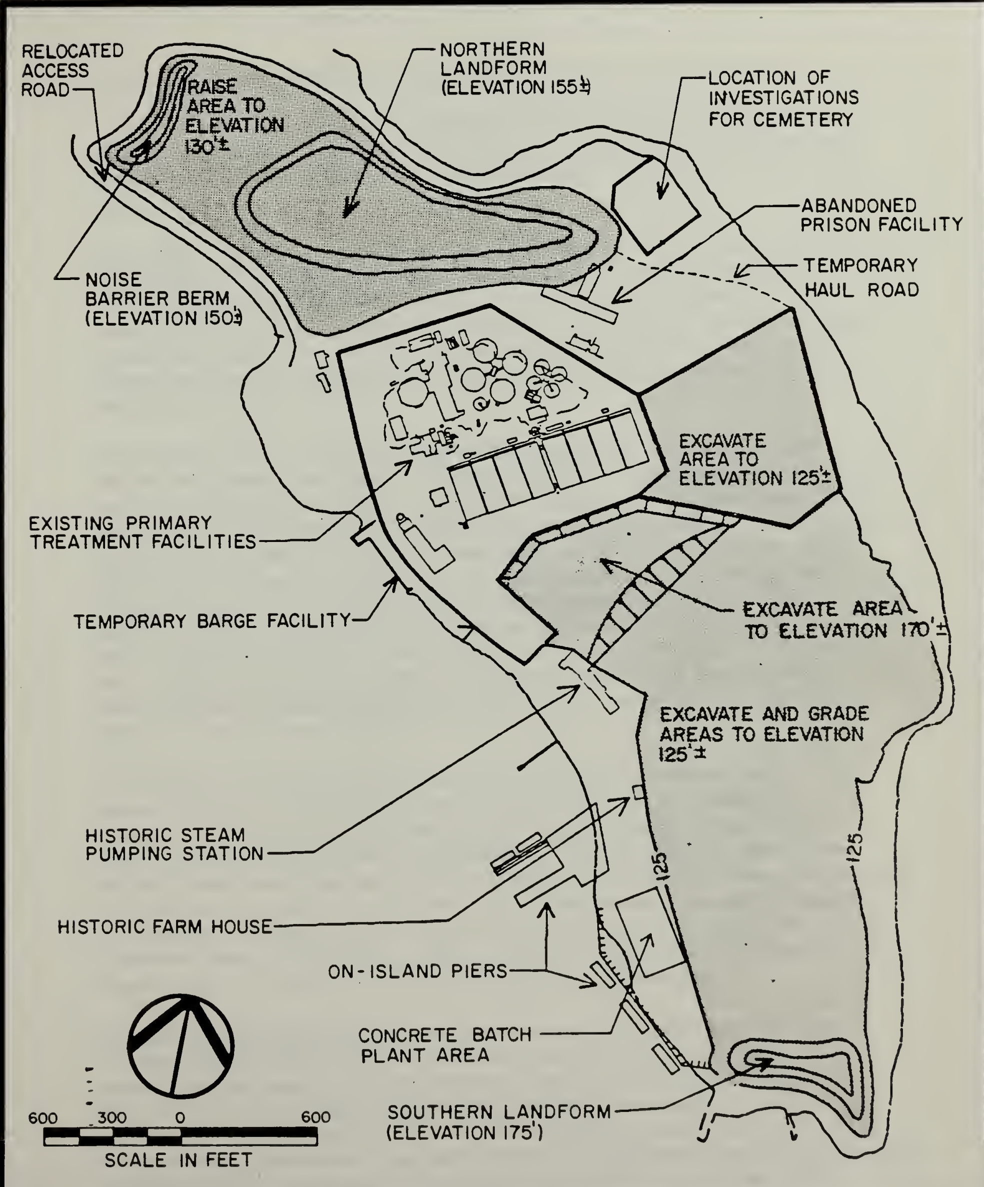
A significant mitigation package was developed as an integral part of MWRA's decision to site the new secondary treatment facilities on Deer Island. A statement of the applicability of each commitment for use as an evaluation criteria for the Secondary Treatment Facilities Plan was provided in the Technical Memorandum - Proposed Criteria for Detailed Evaluation of Alternatives, Secondary Treatment Facilities Plan, May 13, 1987. The environmental impacts of Early Site Preparation will be minimized as a result of several major mitigation steps associated specifically with the recommended plan.

Air Emission Control - The excavation of the grit and screenings disposal areas will have the potential to create odors. These potential odors are likely to be detectable only within the immediate vicinity of the construction areas. To minimize the potential for such odors, the excavation and landfilling of these materials will be performed only during the cooler months to the extent feasible. Furthermore, the landfill surface area and frequency of exposure of the grit and screenings to the air will be minimized by compacting the grit and



MASSACHUSETTS WATER RESOURCES AUTHORITY

FIGURE 1.3-1
EXISTING DEER ISLAND LAYOUT



MASSACHUSETTS WATER RESOURCES AUTHORITY	FIGURE 1.3-2 EARLY SITE PREPARATION FOR DEER ISLAND - RECOMMENDED PLAN (DECOMMISSIONED PRISON)

screenings to one-foot-thick layers, each separated by a six-inch layer of soil for cover.

Fugitive dust from soil excavation and filling activities will be controlled as required by the use of sprinkling trucks. Potable water can be pumped to storage tanks during off-peak hours if sprinkling water requirements are found to place an unusually high demand on the existing supply.

Noise Control - Construction activities generating off-island noise will be minimized by the early building of landforms across the narrow width of the north end of the island using drumlin excavated soils. This mitigation activity, however, is itself a noise generator. To minimize the noise levels generated by the construction of the northern landforms, construction in these northern areas of the island will be restricted to one shift, daytime operations. The complete construction of the landforms will require approximately 350 work days beginning in late 1988 and extending through 1990.

The dominant sources of noise from this activity will be the trucks delivering the drumlin material, the bulldozers and scrapers used to shape the landforms, and the compactors to be used on the north end of Deer Island. The expected initial sound level for construction of the noise barrier berm is approximately 61 dBA at Tafts Avenue on Point Shirley. For construction of the noise barrier berms, special quiet-wheeled bulldozers will be used, supplemented by a mobile crane. Construction of this noise barrier will take approximately one month. By keeping as many activities behind the berm as possible, the anticipated noise level will be reduced to 51 dBA. If the noise barrier berm were not created and standard equipment and normal construction methods were used, the sound level throughout this activity would be 66 dBA. Landfilling construction activities required to complete the raised, northern platform area will generate an estimated noise level of 51-57 dBA at Point Shirley, depending upon the degree of shielding provided by the berm.

Once completed, the noise barrier berm and northern landforms will serve as noise barriers against the sound levels which could be expected at the nearest off-site residence from subsequent early site preparation and construction activities. The expected levels during these subsequent activities are above the Massachusetts DEQE regulations for continuously operating noise sources which stipulate a maximum daytime noise level of 55 dBA which is 10 dBA above the ambient criterion level of 45 dBA. This 55 dBA limitation, however, does not apply to construction noise since the State of Massachusetts does not have any noise requirements for construction noise. For comparison purposes, the City of Boston's code for construction noise stipulates levels of 75 dBA daytime and 50 dBA nighttime and weekends.

Historical and Archaeological Sites - None of the construction activities planned for early site preparation will displace or directly affect any of the historic structures on Deer Island. Early site preparation activities, as shown in Figure 1.3-2 will, however, be in proximity to the steam pumping station, the farmhouse, the historic cemetery, the Hill Prison and the Prison Superintendent's Office. Measures required for protecting these resources will be identified in a Memorandum of Agreement between the Massachusetts Historical Commission, the MWRA and EPA. It is expected that, during early site preparation, the buildings will be

protected against destruction or further deterioration. Earth moving equipment will not be used closer than the concrete wall at the back of the Farmhouse. Shoring of the steam pumping station where it backs onto the central drumlin may be necessary. Openings in the buildings will be closed with plywood. The cemetery will be protected by fencing.

Traffic - Daily traffic impacts from early site preparation activities will be controlled as a result of mitigation measures including on-site placement of excavated soils, selective barging of materials to the site, and off-peak hour scheduling of work shifts for construction workers. Almost all the 40-50 pieces of equipment required will be delivered only once to Deer Island where they will remain for the duration of this phase of the project. The vehicular traffic created by construction personnel involved in early site preparation will average 70 round trips per day. Additional daily truck traffic to support on-site activities and to provide early site preparation materials will average only 2-3 round trips per day. The 17,000 yd^3 of sand associated with the leachate collection system for the new landfill will be barged to Deer Island directly. Approximately 20 barge loads over a 2-3 month period will be required to complete delivery of this material. Barge mooring dolphins and a crushed stone pad will be provided at the barge unloading area to permit delivery of this sand.

Terrestrial and Aquatic Ecosystems - Impacts on the local terrestrial and aquatic ecosystems will be minimal. A majority of the present day site is either used for urban activities or is covered with a scrub growth of coarse grasses and brush. None of the faunal species displaced as a result of vegetation removal, particularly from the central drumlin, are endangered, threatened, or otherwise unique. There are no native biological communities in the service water reservoir.

Because of the extensive surfaces which will be cleared, grubbed, and graded during early site preparation, a mitigation program will be necessary during construction to control erosion and prevent sedimentation into adjacent areas.

Double lining of the secure landfill for grit and screenings will prevent leachate contamination of the island and harbor waters.

Modifications which will be made to an existing rock bulkhead wharf to allow for off loading of sand from barges, will have a minimal impact on marine resources due to the limited nature of these construction activities.

Power Needs - The activities associated directly with early site preparation will not place any significant demands on the site power supply. An increase in the electrical power demand during the early site preparation period will result from other construction activities, such as the construction of pier facilities, interim sludge dewatering, construction of temporary shelters, lighting and miscellaneous demands. Methods of providing the additional power are being evaluated, and will be reported in Volume III, Treatment Plant.

Quantity and Quality of Spoils - Approximately 1.6 million yd^3 of drumlin excavated material and 85,000 yd^3 of grit and screenings will be moved during the early site preparation period.

This material will remain on-island to construct the berms/landforms needed to reduce visual and noise impacts. Approximately 50,000 yd^3 from the Fort Dawes and reservoir demolition will also remain on-island as backfill and berm material.

Costs - Federal and State grant applications for up to 90% of the $17.4 million early site preparation costs will be filed to minimize the financial impacts of this project. Annual operating costs of the constructed facilities are expected to be minimal.

1.3.3 INSTITUTIONAL CONSIDERATIONS

The determinative element for implementation of the recommended early site preparation activities is the requirement for relocation of the House of Correction by 1989. If relocation of the House of Correction is delayed, a phased implementation of early site preparation will be required, which will entail increased costs associated with mitigative measures for the House of Correction.

The recommended secure landfill alternative for the disposal of grit and screenings was evaluated according to institutional criteria previously agreed upon by the MWRA. It was determined that the secure landfill plan represents only modest to moderate difficulty in meeting the institutional criteria of Timely Implementation, Permitting, and External Coordination. There is no Demand for Unique or Scarce Construction Resources, but there is an extensive degree of Internal Coordination required with other Authority projects including daily operations, fast track improvements, pilot program for composting, pier construction, interim sludge disposal, and alternative disinfection.

1.3.4 COORDINATION

During the early site preparation period, ongoing construction activities, existing treatment plant operations and prison operations may affect the progress of early site preparation work should these activities not be properly coordinated, management and controlled. Furthermore, new construction activities, which will occur concurrently with early site preparation activities, may also affect progress. In order to reduce the possibility of interruptions and delays, construction planning and scheduling must include all on-island construction contract work and services.

The activities that will occur on-island during the 1988-1990 time frame are listed below and will be added to the master schedule network.

A. On going Work Activities

- o Fast track improvements
- o Operation of existing primary treatment facilities
- o Operation of prison facilities (until at least 1989)

B. New Work Activities

- o Interim Sludge Disposal
- o Construction of the on-island piers
- o Construction of the interim scum facilities
- o Grit and screenings removal and reburial
- o Temporary utilities installation
- o Relocation of underwater cable to Deer Island Light
- o Provision of alternate service water system
- o Protection of existing outfall
- o Demolition and removal of Fort Dawes and reservior
- o Excavation of central drumlin and landform development
- o Relocation of access facilities

These activities will be planned and scheduled by successor constraints in the project master construction schedule network plan, and will require daily monitoring to insure that all design requirements and MWRA mitigation commitments are fully accomplished.

Section 2

2.0 INTRODUCTION

2.1 PROJECT NEED

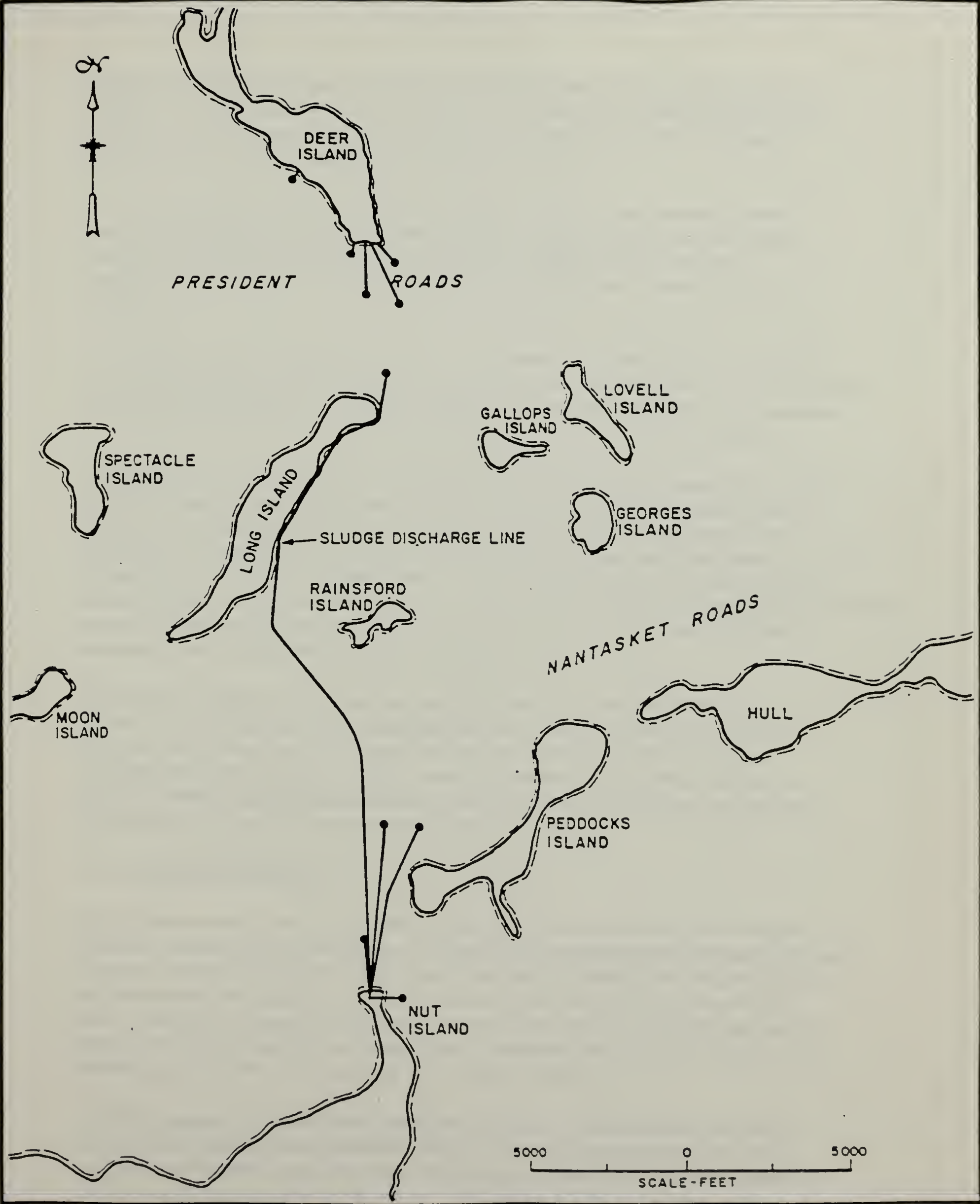
Since the time of the Revolutionary War, Boston Harbor has been considered a national landmark. The largest seaport in New England, it supports a variety of marine activities including shipping, fishing, boating and recreation. It encompasses an area of 47 square miles bordered by residences, commercial buildings, restaurants, marinas, beaches, industries and shellfishing flats. But since the settlement of Boston's shore areas, and most particularly since the City of Boston took possession of Deer Island for "sanitary purposes" in 1847, the Harbor has served as a repository for all of the domestic, commercial and industrial sewage and stormwater from the Boston metropolitan area.

Today, nearly 5,000 miles of sewers, conduits and pipes collect sewage from 1.9 million people and 43 metropolitan cities and towns and transport it to the area's two sewage treatment plants at Nut Island and Deer Island for treatment prior to discharge to Boston Harbor. Both of the plants are designed to provide primary treatment. Each plant provides disinfection of the primary effluent prior to discharge to the Harbor to reduce the levels of pathogenic bacteria. The disinfected effluent from Deer Island is discharged through two diffuser equipped outfalls into President Roads approximately 1,500-2,000 feet from Deer Island. Three additional relief outfalls are located 500-750 feet from Deer Island.

The disinfected effluent from Nut Island is discharged north through two main outfalls into Nantasket Roads approximately 4,500-5,000 feet from Nut Island. During periods of high flows and/or extremely high tides a third outfall extending about 1,500 feet north into West Gut may be used. In addition, an emergency outfall extends 500 feet into the Hingham Bay side of West Gut.

The sludges removed from both plants are stabilized and discharged into President Roads on the outgoing tide. Figure 2.1-1 illustrates the location of each of the treatment facilities and discharge locations. The combined discharge of primary effluent and sludge to the relatively shallow waters of Boston Harbor imposes a significant burden on the marine ecology in the waters surrounding the discharge. The discharge of floatable materials results in a significant deterioration in the aesthetic qualities of this vital resource. Because these discharges are but a few of the total discharges to Boston Harbor, and because scientific research to delineate the impacts of each discharge on the harbor has been limited to date, the precise impacts of the primary effluent and sludge are difficult to quantify. However, these discharges are unquestionably very sizable and the materials being discharged are ecologically significant. Thus, every reasonable effort should be made to reduce these discharges.

The Deer Island treatment facilities were constructed in 1968, and the Nut Island treatment facilities in 1952. Both facilities have exceeded their useful lives and the levels of treatment provided are often less than optimal because of the unavailability of equipment. Nut Island has recently undergone a rehabilitation of most of its major components. A similar rehabilitation is now underway for Deer Island. Rehabilitation of the existing treatment



MASSACHUSETTS WATER RESOURCES AUTHORITY

FIGURE 2.1-1
DEER ISLAND AND NUT ISLAND EFFLUENT AND SLUDGE DISCHARGE LOCATIONS

facilities will optimize the levels of removal that these facilities can consistently provide. However, even the rehabilitated facilities cannot provide the levels of treatment desired. The design criteria and installed equipment of the existing primary facilities do not represent state-of-the art technology; therefore, they require replacement.

The 1972 Federal Clean Water Act requires that all municipal sewage treatment systems incorporate secondary treatment. Secondary treatment is more complex than the primary treatment that the flows at Nut Island and Deer Island currently receive, removing significantly higher levels of both organic materials and solids from wastewater (80 to 90 percent).

Like the Federal Water Pollution Control Act, the Massachusetts Clean Water Act requires promulgation of water quality standards for waters within the Commonwealth. The Massachusetts Division of Water Pollution Control has established these standards to satisfy the requirements of both acts. Thus, both Federal and State statutes require increased levels of treatment.

In 1982, the City of Quincy filed a suit against the Metropolitan District Commission (MWRA's predecessor agency) charging violations of laws prohibiting discharges into coastal waters and tidal waters, and violations of the common law of nuisance. As the suit progressed, the Massachusetts Water Resources Authority was created by the Massachusetts legislature. Almost simultaneously with MWRA's creation, the U.S. Environmental Protection Agency filed suit against MWRA alleging violations of the Clean Water Act. The Federal District Court found MWRA to be in violation and ordered the Authority to plan and construct new treatment facilities in accordance with an aggressive schedule (see Section 3.4.)

The need for upgraded and expanded treatment facilities to serve the Boston metropolitan area is clear: current discharges place a significant burden on one of the area's vital natural resources; the existing treatment facilities have long exceeded their useful lives; the existing treatment facilities do not reflect state-of-the-art technology and design; Federal and State statutes require enhanced levels of treatment; and the Federal Court has intervened and ordered an upgrading of the treatment facilities.

2.2 PLANNING APPROACH

This facilities planning study provides the foundation for the Massachusetts Water Resources Authority's program for the construction and operation of new primary and secondary wastewater treatment facilities at Deer Island. This planning has been approached with the understanding that the facilities planning effort must secure and sustain the acceptance and support of the diverse community, government and business interests that it affects. Therefore, the planning process was based not on technical strength alone, but also on the continual reconciliation of political, legal, environmental, economic and community interests.

A critical component of the facilities planning for secondary treatment facilities has been completed: the siting of the new treatment facilities. The decision-making process and the mitigation commitments made during that siting process are considered to be firm guidance for the planning to be undertaken in this project. (See Section 3.2 for a description of the

siting decision.)

The successful treatment of wastewaters from the Boston metropolitan area requires not only that enhanced treatment facilities be provided, but also that reliable, environmentally sound facilities be provided to manage the disposal of the residuals that are the direct by-products of wastewater treatment. The residuals management facilities plan is being conducted as a separate but concurrent study. The facilities needed and the sites being considered for residuals management are quite different from those needed for secondary treatment. However, the schedule for completion of the residuals management facilities plan is similar to the schedule for this plan. In addition, the approach and work plans for both of these planning studies recognize the synergistic relationship of these two plans. Thus, this planning study must be read with full cognizance of the residuals management facilities planning.

The facilities needed to provide secondary treatment include new primary and secondary treatment facilities located on Deer Island; a new conduit to convey the wastewaters from the existing Nut Island plant to Deer Island (inter-island conveyance facilities); and a new outfall to discharge the treated effluent into the ocean. In addition, a fourth component has been identified for the project: early site preparation. Early site preparation is defined as any construction activity that can start at an early date, i.e., before the completion of the on-island piers facilities needed to move the construction materials, equipment and personnel to the Deer Island site. The facilities planning for secondary treatment has thus been broken into four, stand-alone studies:

Treatment Plant, Volume III
Inter-Island Conveyance System, Volume IV
Outfall Plan, Volume V
Early Site Preparation, Volume VI

To expedite the planning and review process, the facilities planning for secondary treatment has received a designation as a "major and complicated" project under the Massachusetts Environmental Policy Act regulations. The "major and complicated" project designation permits the environmental reviews to be concurrent with, and an integral part of, the facilities planning process. Thus, the documents being prepared to summarize the facilities planning are the same documents which will be used for environmental reviews.

The scope and sequencing of these facilities planning and environmental review activities are described in the following section.

2.3 SCOPE OF WORK

The purpose of the Secondary Treatment Facilities Plan is to evaluate the facilities needed to provide primary and secondary treatment, at a single facility to be located on Deer Island, of the wastewater conveyed through MWRA's North and South Systems. It will evaluate the facilities needed to convey the South System flows from the existing Nut Island plant to Deer Island, as well as the outfall facilities needed to convey the effluent flows from Deer Island

to a disposal point in marine waters. It will also identify and evaluate the construction activities which can occur as part of the Early Site Preparation effort prior to completion of the on-island piers and in preparation for the construction of the primary facilities.

The scope of work for the facilities plan is summarized below.

Project Management provides the overall project management required to ensure that the facilities plan is completed on time, within budget and with high standards of quality.

Data Collection inventories current and planned upgraded equipment and processes, assembles data regarding process equipment, mechanical, structural and hydraulic conditions, operating and maintenance characteristics, and expected useful life. Data Collection also will project flows and loadings, define the planning area, and provide a basis for evaluating further growth. This task will develop performance/removal criteria that will be used to balance the level of treatment required and the outfall location.

Facilities Engineering will characterize the wastewater to be treated, develop initial alternative planning and architectural concepts for Deer Island and ancillary facilities at Nut Island; complete site planning requirements; evaluate the adequacy of existing preliminary treatment facilities and evaluate unit processes for screening and grit removal; evaluate unit processes for primary treatment and residuals collection; evaluate unit processes for secondary treatment and residual collection; evaluate unit processes for disinfection; identify and evaluate the ability to control air emissions; establish alternative noise control methods and prepare a noise control plan for treatment plant operations and construction activities; determine the need for a pilot plant; evaluate the route and construction technology for locating and constructing the inter-island conveyance system and new effluent outfall; select an area for the outfall discharge which will meet water quality standards; characterize the soil and rock conditions under the proposed facility and related wastewater conveyance systems; identify and evaluate treatment processes; evaluate the reliability and flexibility of each of the treatment alternatives; estimate capital costs for the selected facilities and equipment; identify and estimate utility needs; identify operator needs and develop a preliminary operations plan; outline the requirements to operate the existing plants during construction; and provide pre-construction planning.

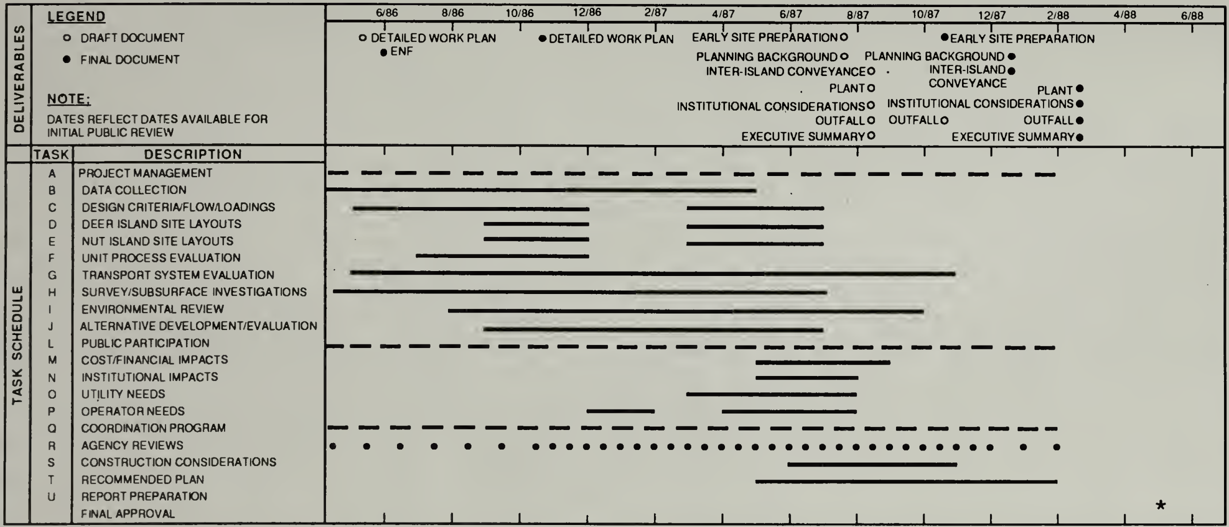
Institutional tasks include development of an annual cash flow projection required for the construction of the facilities; identification of the financial impacts of the recommended plan on MWRA's customers; identification of proposed changes or additional laws, regulations, legislative restrictions and agreements that may affect the implementation of the facilities plan; description of potential permit and regulatory agency approval requirements and preparation of a preliminary permitting plan; and implementation of a full-scale public participation program.

Recommended Plan is the preparation of the Secondary Treatment Facilities Plan and development of an implementation schedule/plan for each design and construction phase, as well as the coordination of, and response to, reviews by regulatory agencies.

A more detailed outline of each work task will be found in Appendix A of Volume II, Facilities Planning Background. Figure 2.3-1 illustrates the general flow of the planning activities.

SCHEDULE OF MAJOR DELIVERABLES

VOLUME	NAME	DRAFT REPORT	FINAL REPORT
I	EXECUTIVE SUMMARY	9/87	2/88
II	PLANNING BACKGROUND	6/87	12/87
III	WASTEWATER TREATMENT PLANT	9/87	2/88
IV	INTER-ISLAND CONVEYANCE SYSTEM	8/87	12/87
V	EFFLUENT OUTFALL	11/87	3/88
VI	EARLY SITE PREPARATION	7/87	10/87
VII	INSTITUTIONAL CONSIDERATIONS	9/87	2/88



MASSACHUSETTS WATER RESOURCES AUTHORITY

FIGURE 2.3-1
SECONDARY TREATMENT FACILITIES
PROJECT PLANNING SCHEDULE

Section 3

3.0 PROJECT BACKGROUND

3.1 PREVIOUS STUDIES

Since 1900, there has been concern over water pollution problems in Boston Harbor. The State legislature initiated six investigations into the condition of the Harbor between 1900 and 1939. The last of these investigations resulted in the construction of the present Deer Island Treatment Plant which was completed in 1968.

But even as the Deer Island Plant was completed, the Federal Water Pollution Control Administration released a report on the impact of pollution on the Harbor's waters citing recreational, economic and biological impairment. The report generated increased interest in addressing pollution problems and at the first Enforcement Conference on Boston Harbor, state and federal officials agreed on the formation of a technical study group to explore measures for pollution abatement. The recommendations and agreements which grew out of these conferences, in conjunction with the mandates of the Federal Water Pollution Control Act and the Massachusetts Clean Water Act, have formed the framework for attacking pollution in Boston Harbor.

The process of identifying long-term wastewater treatment needs and solutions for the greater Boston Metropolitan area began in 1973 when the Metropolitan District Commission (MDC) began work on wastewater engineering and management planning for Boston Harbor. (See Table 3.1-1 for a chronology of wastewater treatment in Boston Harbor). The Eastern Massachusetts Metropolitan Area Wastewater Management and Engineering Study (EMMA) was to ascertain what repair, replacement, extension, and expansion of facilities was required to provide adequate sewage treatment for the next fifty years.

In the fall of 1976, following publication of the EMMA Study, EPA's regional office requested that an Environmental Impact Statement (EIS) be prepared before any facilities planning. When the EIS was completed in 1978, it resolved the controversy regarding satellite facilities and proposed the consolidation of all planned treatment facilities on Deer Island.

A few months prior to the publication of the EIS, the MDC had responded to the 1977 amendments to the Clean Water Act which provided for a waiver of secondary treatment. If a waiver were granted, much of the construction contemplated in the EMMA Study would be deferred, at least until expiration of the modified permit, and perhaps indefinitely if the permit were renewed. Nevertheless, because regulations pertaining to the waiver process required that facilities plans to provide secondary treatment be prepared concurrent with the waiver process, the MDC, following release of the draft EIS, began preparation of a facilities plan.

Starting in 1983, the EPA and the Commonwealth jointly prepared the Supplemental Environmental Impact Statement/ Environmental Impact Report on the Site Options Study. The purpose of this document, which augmented the EIS evaluations done on the EMMA Study, was to review the environmental impacts of the Site Options Study alternatives, as well as other alternatives within the context of both the National and Massachusetts Environmental Policy Acts. The SEIS/DEIR started with twenty alternatives and selected seven treatment plant siting

alternatives for final review. The MWRA later reinstated one alternative for final review. Four alternatives involved secondary treatment and four involved primary treatment. The alternatives considered included locating all treatment at Deer Island, all treatment at Long Island, or combinations of plant locations that used Deer, Long and Nut Islands together in various configurations.

Also in 1983, almost five years after MDC filed a preliminary application for waiver of secondary treatment, the application was tentatively denied by EPA. Because of intervening regulatory developments, MDC was entitled to file an amended application. Shortly thereafter, MDC notified EPA of its intent to do so, and a scope of study was agreed upon, including water sampling to be performed in the summer of 1984. Final submissions were made by MDC in October, 1984.

Although the cost implications of secondary treatment and the ultimate rate-payer impacts promoted pursuit of the waiver application over several years, the waiver application exacerbated two major problems in planning the cleanup of Boston Harbor. First, as long as the "level" of treatment (secondary vs primary) was uncertain, the nature and size of new treatment facilities were impossible to fix for planning purposes. Second, planning for sludge management was frustrated because of the disparity in both the tonnage and character of sludge from secondary treatment as opposed to primary treatment.

On March 29, 1985, EPA rejected MDC's amended Section 301 (h) waiver application.

The Massachusetts Water Resources Authority assumed control of the MDC sewerage system on July 1, 1985. The MWRA made the decision to proceed as fast as possible with the secondary treatment program for Boston Harbor, notifying EPA that they would choose a preferred alternative for focused analysis by early July, 1985.

Table 3.1-1 is a listing of planning projects undertaken for Boston Harbor wastewater treatment since the 1976 EMMA study.

TABLE 3.1-1

SUMMARY OF PLANNING REPORTS FOR WASTEWATER TREATMENT IN BOSTON HARBOR

1976, March	Eastern Massachusetts Metropolitan Area Wastewater Engineering and Management Plan of Boston Harbor, Metcalf & Eddy, Inc.
1976	Non-structural Controls for Combined Sewer Overflows, Environmental Research and Technology, Inc.
1976, May	Joint Task Force Report on Major Manned MDC Facilities located in the Greater Boston Area, EPA Region I
1976, July	Wastewater Management Planning: Boston Metropolitan Area Phase I Study, Urban Systems Research and Engineering, Inc.
1976, July	Phase I Engineering Report Boston Case Study, Kennedy Engineers, Inc.
1976, August	Phase I Final Report on Greater Boston Water Quality Issues in Planning for Pollution Control, Verlex Corp.
1976, November	Boston Metropolitan Area Waste Treatment Feasibility Study, Stone & Webster Engineering Corp.
1979, January	Wastewater Treatment Facilities Planning in the Boston Metropolitan Area - A Case Study, Kennedy Engineers, Inc.
1979, September	Application for Modification of Secondary Treatment Requirements for Discharge into Marine Waters of Boston Harbor and Massachusetts Bay for its Deer Island and Nut Island Wastewater Treatment Plants, MDC
1980, December	MDC Headworks Grit and Screenings Removal Systems - Preliminary Report, Whitman and Howard, Inc.
1982, June	The Commonwealth of Massachusetts Nut Island Wastewater Treatment Plant Facilities Planning Project, Phase I, Site Options Study, Volumes I and II, Metcalf & Eddy, Inc.
1982	Nut Island Wastewater Treatment Plant Immediate Upgrading, Metcalf & Eddy, Inc
1984	Deer Island Facilities Plan, Havens & Emerson/Parsons Brinkerhoff

TABLE 3.1-1

SUMMARY OF PLANNING REPORTS FOR WASTEWATER TREATMENT IN BOSTON HARBOR
(Continued)

1984	Supplemental Draft Environmental Impact Statement and Draft Environmental Impact Report, EPA
1984	Application for a Waiver of Secondary Treatment for the Nut Island and Deer Island Treatment Plants, Metcalf & Eddy, Inc.
1985, November	Final Environmental Impact Report on Siting of Wastewater Treatment Facilities for Boston Harbor, Camp Dresser & McKee, Inc.
1985, December	Final Environmental Impact Statement on Siting of Wastewater Treatment Facilities for Boston Harbor, EPA

3.2 SITING DECISION

The MWRA determined that the seriousness of the siting decision to be made and the newness of the MWRA as a participant in the decision process merited a thorough review of the material presented in the SDEIS/DEIR and comments made pursuant to that document, as well as a consideration of all additional information being developed in response to the issues raised by those comments.

The MWRA began its site selection process by reviewing the six criteria established in the SDEIS/DEIR (i.e., cost, effect on natural and cultural resources, effects on neighbors, harbor enhancement, implementability, and reliability). The MWRA voted to adopt these six criteria, but determined that two additional criteria should be adopted as well: equitable distribution of regional responsibility; and mitigation measures. The first of the new criteria, equitable distribution of regional responsibility, was viewed as subsuming the "fairness" issue which had been the subject of substantial commentary on the SDEIS/DEIR. The second new criterion, mitigation measures, was adopted to ensure consideration of both environmental and non-environmental mitigation and to permit the MWRA to fully respond to mitigation concerns during its siting deliberations.

The MWRA next reviewed the site options to be considered. It voted to examine the seven site alternatives proposed at the conclusion of the SDEIS/DEIR (all secondary Deer Island, split secondary Deer Island and Nut Island, all secondary Long Island, split secondary Deer Island and Long Island, all primary Deer Island, split primary Deer Island and Nut Island, split primary Deer Island and Long Island) and, in response to the Secretary's Certificate of Adequacy on the SDEIS/DEIR, also voted to reinstate for evaluation one site option that had been dropped from consideration at the close of the SDEIS/DEIR (all primary Long Island).

The MWRA then proceeded to an evaluation of each site alternative in the context of the criteria selected. A number of consultants were engaged to assist in the collection, evaluation and presentation of pertinent materials to the Board members at their publicly held meetings. Oral and visual presentations on each of the eight criteria were given, followed by questions and discussions which refined the issues to be addressed and identified further information to be obtained. Second presentations and discussions were held on seven of the criteria, and a third round of review and debate occurred on the criterion of cost. As a consequence of these deliberations, further presentations and discussions were held on several sub-topics that were of particular interest or thought to require additional attention.

In addition to its own consultants' presentations, the MWRA heard and discussed presentations by the Regional Administrator of EPA, by representatives of the Executive Office of Environmental Affairs and the Department of Environmental Quality Engineering, and by the technical and legal representatives of the Town of Winthrop and the City of Quincy. In all, the MWRA listened to and discussed at some length, 23 separate presentations on 13 different topics applicable to the preferred alternative siting decision.

A summary of all the siting presentations given and the Board's discussions was provided to the Board members for further review and analysis prior to the vote on the tentative preferred

alternative site selection. Copies of letters from officials and the public concerning the siting decision were either provided to Board members during the ongoing deliberations or were included in the siting summary notebook. The Board members also visited the sites being considered.

The following sub-sections contain summaries of the MWRA's deliberations concerning each criterion as it applied to the site selection to be made. Throughout the process of selecting the tentative preferred alternative site, the MWRA evaluated and compared the information received in light of the criteria adopted. It observed interrelationships among the criteria and discussed the value to be accorded to the criteria in the context of various site alternatives. The last sub-section summarizes the way in which the criteria weighed one against the other with respect to the sites considered.

Effect on Neighbors

The purpose of this criterion was to address treatment facility impacts on the neighbors of the treatment plant. Factors evaluated by the MWRA were traffic, noise, odor, visual effects, property values, and health and safety issues. An exploration of the numbers of persons potentially impacted by the proposed primary, secondary and split treatment plant site options was conducted. Distinctions were made between those who might be voluntarily exposed to the negative impacts and those who resided nearby and had no choice with respect to being impacted, with greater value being accorded to the latter. Consideration was also given to the potential impact of the treatment plant on those working, living or staying at either the hospital on Long Island or the prison on Deer Island. Weight was attached to the fact that persons in the institutions would be closer to the source of impacts for longer continuous periods and would be exposed to a higher degree of impact at any given time. Concern about the effects on these populations served in part to motivate the MWRA to analyze in more detail the "footprints" that could be accommodated on Long Island and on Deer Island and the need for and feasibility of mitigative design concepts, buffers, and/or the relocation of the respective institutions. Also considered was the exposure to impacts over a longer period of time as would be the case for most of the residential neighbors.

Traffic. Traffic access roads were reviewed for capacity and for anticipated peak and average use with and without the utilization of barging and busing. The MWRA learned that the greatest numbers of persons would be affected along the Winthrop access routes, but that a substantial number of persons would be affected along the East Squantum access routes as well. The fewest persons would be affected if the Quincy Shore Drive route to Long Island was available, but there were questions of implementability and structural feasibility that would have to be resolved in order to use that route. The degree of negative impact on the various roads was considered to be roughly the same for the various site alternatives.

A great deal of consideration was given to barging, with the recognition that it was required in order to sufficiently mitigate the traffic impacts that would be caused during construction. Implementability issues with regard to barging -- such as Coast Guard regulations and the construction of piers -- were explored, as were the costs of barging. A determination was made that the same requirements for barging applied to whichever site alternative was selected, and

therefore the concerns surrounding barging as a mitigation measure for the alleviation of traffic impacts on neighbors were found to be not site-determinative.

Also reviewed were the potential mitigation measures of ferrying workers to decrease traffic, and rehabilitating or replacing access bridges to accommodate heavy trucking. Implementing each of these measures appeared to pose a relatively similar degree of difficulty between sites and was not found to be an absolute deterrent. The cost of bridge repair or construction did differ between sites and was explored in greater detail by the MWRA in its concern for the issue of traffic impacts and the need to alleviate them. It was determined that it would be most costly to repair, replace or construct new bridges for access to Long Island.

Assuming a heavy reliance upon barging and taking into account the above factors, the MWRA concluded that the traffic impacts were significant but manageable with respect to all sites, and that this was not a site-determinative factor.

<u>Noise</u>. The information on noise contained in the SDEIS/DEIR was reviewed, and the concerns of the Town of Winthrop with respect to the adequacy of that information and the possible site-determinative nature of construction noise impacts were explored. Berms and temporary noise barriers were also discussed. The MWRA received a detailed letter from, and heard a presentation by, Winthrop's technical consultant. It further pursued additional noise information through the technical advisory group meetings and shared the ongoing work done by EPA's technical consultant. An update of this work was presented to MWRA by EPA shortly before MWRA's siting decision. The information on noise gathered and presented by EPA and adopted by MWRA for its tentative preferred alternative site selection indicated that although noise levels at Deer Island would result in greater impact to neighbors, particularly the close neighbors at the House of Correction, the level of construction noise at either site was at acceptable levels or could be sufficiently mitigated so that it was not a site-determinative issue.

<u>Odor</u>. The impact of odors, taking into consideration source, distance, population density, and potential for occurrence, was also evaluated. In addition to evaluating the effect of odors on nearby residences and the existing institutions, the MWRA considered the effect of odors on potential recreational users. It was determined that there might be intermittent effects on neighbors at either site with a potentially substantial effect on recreators at Long Island Head, given the seasonal wind patterns and projected siting plans.

The use of covered tanks to mitigate odors was explored. The MWRA balanced the mitigating effect of covered tanks against the operation and management difficulties that had been experienced at other plants utilizing covers and also considered the additional cost required to employ covered tanks.

After reviewing odors and their potential impact on any of the sites considered, the MWRA determined that odor control was a paramount concern in the design of the treatment plant and that stringent odor controls would be utilized no matter where the treatment plant was located. Having decided this, and having reviewed the odor impact information, the MWRA concluded that odor and its control posed somewhat different problems at each island but balanced out

sufficiently so as not to be a site-determinative issue between Long Island and Deer Island.

Odor impacts were found to have some significance, however, in the choice between all secondary options that retained the existing institutions and those secondary options featuring removal of the hospital or House of Correction. The options featuring retention of the existing institutions were considered less desirable because the ability to design the treatment plant with odor sources farther away from residential or recreational uses was substantially reduced at the more constrained sites. The retention of the institutions also increased the number of persons impacted and degree of severity of impact with respect to the persons living, working or staying in the institutions.

Visual Effects. It was determined that a treatment plant on either island would have a negative impact on persons in the existing institutions due to proximity. With respect to residential neighbors, it was determined that if the institutions remained, there would be a greater negative impact from a treatment plant on Deer Island. If the House of Correction were removed, however, modifying landforms and landscaping could be used to screen the treatment plant from most residences.

Property Values. The effect on property values of the construction and operation of the treatment plant was addressed. Comparisons of affected communities with respect to fair market value, past appreciation, turnover rates and anticipated changes due to treatment plant construction and operation were reviewed. It was generally concluded that, no matter which site option was selected, property values probably would not decline during successful plant operation. However, there was discussion that there may be a decline of property values for communities near the treatment plant during construction but that these values would likely rebound fully after completion of construction. Also discussed was a projected possibility that property values around Deer Island might not fully rebound after construction. However, it was also deemed possible that the substitution of a carefully constructed and well-run treatment plant on Deer Island might raise values in the neighboring communities higher than they would be with the continuation of the existing plant operation. On the whole, property value impacts were determined not to be site-determinative, but a matter to be addressed through mitigation once a site was selected.

Health and Safety. Health and safety concerns of the community -- such as traffic impacts on schools and the elderly, chlorine delivery, air quality reduction from traffic or the facility operation -- were examined and not found to be site-determinative factors.

Summary of Effects on Neighbors. Most of the effects considered within each of the above sub-categories of effects on neighbors were found to be roughly equivalent when applied to the various site options. Although there were perceived imbalances of effects under some of the sub-categories, imbalances against one site under one sub-category tended to be neutralized by imbalances against another site in another sub-category. For example, imbalances found against the use of Long Island for either all secondary or mixed alternatives due to the additional cost of the traffic mitigation measures of repairing or replacing access bridges tended to balance out against the additional cost that might be required for noise mitigation on Deer Island, particularly if the House of Correction was not removed.

Similarly, the imbalance against Long Island caused by the determination that more substantial odor effect was likely on potential recreators was balanced against the possibility for greater negative visual impacts on residential neighbors from a treatment plant on Deer Island if the House of Correction was not removed. In sum, when all the effects were weighed within the sub-categories and the total effects of each sub-category were weighed one against the other, the MWRA concluded that the criterion of effects on neighbors, as a whole, was not site-determinative.

Equitable Distribution of Regional Impacts

Equitable distribution of regional impacts was adopted by the MWRA as an additional criterion in response to the issues of fairness raised in the comments on the SDEIS/DEIR. The criterion brought into the decision process considerations of how many and what kind of impacts a community might already bear from proximity to regional facilities other than the contemplated treatment plant. For example, impacts on Winthrop from Logan Airport, the Deer Island House of Correction and the current Deer Island treatment plant were reviewed, as were the effects on Quincy of the existing Nut Island treatment plant and flight patterns from Logan Airport. Distinctions were made between regional uses that provide little benefit to the community impacted (such as Logan Airport vis-a-vis Winthrop) and those regional facilities which daily serve a number of residents of the impacted communities (such as MBTA stations in Quincy). It was further noted that the impact from the latter use was mitigated by the existence of a local-aid fund which provides some monetary reimbursement to host communities.

The consideration of regional use burdens on potentially impacted communities had two applications in the preferred alternative siting decision. First, there was an assessment of whether or not the cumulative regional burdens on any one particular community would be so excessive if the treatment plant were sited nearby as to require, without regard to any other criteria, that the treatment plant be sited elsewhere. One decision-maker concluded that the cumulative and long-term burdens imposed on Winthrop currently and in the past required a decision to site the treatment plant at a location other than Deer Island. Other decision-makers decided that the degree of unfairness did not rise to the level of unilaterally precluding the siting of the treatment plant on Deer Island.

The second way in which the criterion of equitable distribution of regional impacts was applied was to broaden the scope of factors to be considered in assessing effects on neighbors and in determining the nature and degree of mitigation measures to be undertaken. As to the former, the impacts of other regional uses were evaluated not only separately, for their effect on the community, but as they might combine with the noise, odor, and other impacts of the proposed treatment plant.

In assessing the impact of regional facilities on the various communities, the MWRA concluded that the choice of any of the alternative site options was unfair to whichever of the communities were impacted, by virtue of the burdens to be borne by those particular communities on behalf of so many other communities. When contrasting the relative regional burdens between the impacted communities, some decision makers noted that the greatest share of burdens for regional impacts was already borne by the City of Boston and that Boston's burdens would be

increased whichever option was chosen. Between the City of Quincy and the Town of Winthrop, the MWRA concluded that the greater number of regional burdens borne by Winthrop made it more unfair to Winthrop to locate the plant on Deer Island than it was unfair to Quincy to locate the treatment plant on Long Island.

Cost

From the outset of its deliberations, the MWRA considered cost to be an important criterion. One of the first tasks the MWRA undertook was to closely examine the previous cost estimates which had been included in the 1982 MDC Site Option Study and the SDEIS/DEIR. Those cost estimates and a new set of estimates prepared by MWRA's consultant were analyzed and discussed both as to the absolute dollar figures presented and as to the relative differences in costs between sites.

Following the initial presentation to and discussion of these figures by the MWRA, consensus was reached by the various cost estimators which reduced the range of difference among them by half. The MWRA reviewed the original figures, the new figures, the basis for each and the rationale for the differences. It recognized that the figures could be firm to only a certain degree, given that a site was being selected prior to any facility design being undertaken. The MWRA chose to consider the higher figures in the range as better representing the most conservative case for design and construction needs and choices, including but not limited to greater assurances of reliability through increased redundancy and mechanical backup.

At each stage of development of the cost figures, the MWRA determined whether the differences changed the ranking or rating of the site alternatives or the relative differences between the alternatives appearing in the SDEIS/DEIR. As to the first two stages of development in cost estimates described above, the MWRA concluded that the ranking or rating of alternatives remained the same and the relative difference between the sites remained constant no matter which estimates at which level of refinement were used.

However, as the deliberations of the MWRA with respect to the other criteria continued, it became evident that cost was closely intertwined with assessments of those criteria and constituted an important factor for each item evaluated. As a result, further discussion and inquiry on costs were undertaken by the MWRA, and a third and more detailed cost analysis was produced. The resulting figures were reviewed and discussed by the MWRA. It was determined that while the new figures narrowed the difference in cost between some of the options involving Long Island and some of the options involving Deer Island, it did not change the ranking of any of the site alternatives.

The MWRA also developed and discussed a comparison of costs between Deer Island and Long Island with and without the existing institutions. The MWRA concluded that in all cases, it was less costly to construct the treatment plant on Deer Island as compared to constructing it on Long Island. It further determined that it was less costly to construct the treatment plant on either of the islands without the respective existing institutions being present.

Implementability

The MWRA utilized the implementability criterion to assess how quickly and how predictably the treatment plant could be completed at each of the alternative sites. This included a review of the requirements for and potential impediments to obtaining the real estate necessary for the construction of the treatment plant under the various alternatives. After examining the ownership and the means by which that ownership could be transferred, the MWRA concluded that obtaining the required land under all the options was roughly equal in terms of the legal steps to be taken and the likelihood of success.

The MWRA also reviewed the various permits, licenses and approvals that would be required from federal, state and local authorities in order to build the treatment plant under the various site plans proposed. It found that most of the state and federal permits required were equally applicable to Deer Island and to Long Island. It noted that burial grounds and archaeological/historical properties were a significant issue with respect to Long Island and would probably require extensive mitigation efforts, but also took into account that Deer Island had historic resources that might require consultation with authorities and possible mitigation. Similarly, the MWRA examined the conclusion of the SDEIS/DEIR that the permit issues surrounding burial grounds principally impacted Long Island, but also noted the possibility that they might be involved with Deer Island as well. With regard to the loss of historical or archaeological resources, the MWRA gave weight to the fact that the necessary consultation, mitigation and approval process for whichever island was selected could be engaged in concurrently with the facility planning and design process for the treatment plant, and would not greatly delay the construction of the facility. It was also considered important that this approval process, while requiring consultation and mitigation, could not prohibit the construction of a treatment plant on either island.

Further implementability issues that might apply to only one of the islands, or might be more difficult on one island as compared to the other, were examined. These included wetlands, order of Conditions, bridge construction, barrier beaches, opening of Shirley Gut, air quality questions, possibility of contaminated dredge spoils, existing grit and screenings, hospital relocation and House of Correction relocation. The first three of these issues were thought to have more certain application to Long Island but were considered to have possible application to Deer Island as well. The middle three issues were looked at as possibly raising additional or more difficult issues in the case of Deer Island. Air quality issues were discussed with EPA, and further information obtained by the EPA indicated to the MWRA that the treatment plant could be located at either island without violating national ambient air quality standards for air pollution under the configurations being considered by MWRA and by EPA.

Implementability of relocating the existing institutions on Deer Island and Long Island was scrutinized very closely by the MWRA. The MWRA heard and considered presentations by legal counsel to the City of Quincy and the Town of Winthrop on the need for and comparative legal difficulty of relocating the institutions. The MWRA also received and evaluated communications from the Governor of the Commonwealth, the Mayor of the City of Boston and the Speaker of the Massachusetts House of Representatives. The MWRA concluded that, as to real estate and permit approval issues, the various site options balanced out with respect to implementability. The

removal of the House of Correction from Deer Island, however, was felt by the MWRA to be more feasible than removal of the Long Island Hospital, considering the commitments made by the authorities who would be in a position to implement the respective relocations.

Reliability

The MWRA viewed reliability as the concept of enhancing the overall integrity of the waste treatment system. Information was received on such factors as minimization of detrimental consequences of outages, operational capabilities during and after construction, managerial enhancement and technological reliability. Particular issues of reliability were explored in more detail. The performance of a secondary treatment system was reviewed at some length with stress on the need for proper design to handle such things as variable loads and intake of septage to prevent a malfunctioning of the system which would result in partially treated sewage being released into the harbor through a short outfall. The reliability of tunnels was reviewed, and the use of round versus rectangular clarifiers was discussed. Also considered was the need for backup in the case of catastrophic outages.

With regard to clarifiers, the Board heard that circular clarifiers were considered more reliable by some and that use of those clarifiers would require a greater acreage and expenditure to install, but it also heard that a comparable degree of reliability could be provided by rectangular clarifiers, which use less space and are less costly. The MWRA determined that either type of clarifier could be utilized under the various site options being considered.

The greater or lesser use of tunnels under any particular site option was considered to be an insignificant factor since it was determined that reliability of tunnels could be assured through proper design and maintenance during construction and operation. There was a recognition that those site options with split plants would provide greater reliability in the case of catastrophic outages, but this fact was determined to be offset by the consideration that such outages could be expected to occur at very infrequent intervals and that the ability to achieve reliability at split plants would be more costly because of the need to provide two sets of administration and staffing.

In assessing the various site options in light of reliability factors, the MWRA concluded that, while reliability was a very important consideration in constructing and operating the wastewater treatment plant, it was not a determinative factor in selecting site options between Long Island and Deer Island. Reliability was viewed by the MWRA, however, as a very important factor in its relationship to impact on neighbors. Any reduction of efficiency or increase in operational malfunctions would potentially create greater negative impacts, such as odors, on the neighborhood. It was also recognized and considered an important factor that the capital cost of the secondary treatment plant would be greatly increased by the design and engineering which would be necessary to protect against the greater unreliability inherent in a constrained site. Also, higher operational and maintenance costs would have to be anticipated as a result of the more complex design that would be required.

Weighing all these factors, the MWRA concluded that greater reliability would be obtained in

any of the secondary treatment plant options if the respective existing institutions were removed and, conversely, that reliability would be severely impacted if the secondary treatment plant was built without removing the respective institutions. In any other regard, reliability was considered to be equally obtainable at all site alternatives considered and therefore not site-determinative.

Harbor Enhancement

The MWRA's view of harbor enhancement incorporated compatibility of the proposed treatment plant with attainment of the harbor's potential. The MWRA reviewed the site alternatives not only with respect to how each site option might serve as a source of impact on the harbor but also as to how each option might serve as an opportunity for achieving the objectives listed. This information for the site options -- as they related to one another and to the harbor as a whole -- was then considered.

Certain concerns of the MWRA were further explored. The potential for recreational use of Deer Island was reevaluated and discussed. As a result, the MWRA accorded greater weight to the recreational potential of Deer Island than had been previously assigned to it in the SDEIS/DEIR. The MWRA concluded that the recreational potential of Deer Island and of Long Island, absent any development, was similar in a number of ways with many of the same types of activities potentially available. Two differences were found to favor the preservation of Long Island's recreational potential, however. The first was the greater potential for public swimming beaches at Long Island. The second was the wilderness experience derived from the wild vegetation in the undeveloped parts of Long Island which, once destroyed, could not be recreated elsewhere.

The two islands were also reviewed for compatibility of recreational use with a treatment plant present. If the existing hospital were retained along with the treatment plant, Long Island would lose the significant recreational potential of Long Island head but might retain its barrier beaches, whereas if the existing House of Correction were retained, Deer Island might be able to encompass a small naturalized park located at Deer Island head. If neither existing institution remained along with the treatment plant, a park at Long Island head and an environmental study area in the southwest of long island could possibly be preserved, while at deer island, a neighborhood park and a regional park could be created and the natural beaches preserved.

It appeared to the MWRA that the quality of recreation on the islands -- co-existent with a treatment plant but without the existing institutions -- was higher for Deer Island than Long Island. At Deer Island, existing or man-made landforms could screen recreational areas from nearby receptors. At Long Island, the treatment plant would be highly visible, and the wind patterns might carry the odors over Long Island Head a significant amount of the time. In balance, the MWRA felt that greater recreational potential for the harbor would be available by building the treatment plant on Deer Island rather than Long Island with or without the existing institutions, but particularly in the latter case.

The MWRA also considered implementability of recreational plans. It was noted that Long Island

was physically ready to be developed for recreational use almost immediately if no treatment plant were sited there, but that a much longer time would elapse if recreational use had to wait until a treatment plant was operational on Long Island and the Deer Island treatment plant subsequently removed. The availability of funds for recreational development of Long Island as an already established priority in the Boston Harbor Islands Park system enhanced the likelihood of recreational development of Long Island in the near future.

In assessing the visual effect of the various treatment plant site options, it was determined that the primary and secondary treatment plant options at Long Island were deemed to produce the most radical changes to the natural terrain and to impact the most negatively on the harbor as a whole.

Having reached the above conclusions and having evaluated the information contained in the SDEIS/DEIR, the MWRA concluded that harbor enhancement would be promoted by the preservation of Long Island as a potential park resource and, conversely, that the harbor would be diminished both visually and for recreational purposes, if the treatment plant were constructed on Long Island.

Effect on Natural and Cultural Resources

The MWRA examined the natural and cultural resources that would be impacted by each of the site option alternatives. In addition to the information contained in the SDEIS/DEIR, summaries further distilling the information and updated reports of ongoing evaluations of the sites by the Massachusetts Historical Commission were heard and evaluated. The MWRA not only considered the number and significance of historical, cultural and archaeological structures and sites, but also the degree of mitigation that might be required if such places and things were disturbed. The possible effect of any mitigation measures on duration and cost of construction was then assessed. The MWRA also gave some weight to the nomination or intended nomination of those items to the National Register of Historic Places.

The MWRA took into account the number of archaeological sites in existence, the rarity and integrity of such sites, the contribution of such sites to an understanding of our history, and the quantity of material contained in the sites. It was noted that no archaeological sites had been uncovered at Deer Island, but the MWRA also took into account that there had not been as thorough a survey of parts of Deer Island as there had been for the whole of Long Island. Nevertheless, in reviewing the five prehistoric sites uncovered at Long Island, the MWRA determined that their preservation deserved stronger consideration in the choice of a site.

With regard to cemeteries, the MWRA contrasted the existence of several cemeteries on Long Island with the possible existence of a cemetery on Deer Island. Again, however, it noted that Deer Island had not been as intensively surveyed as Long Island. It noted that Long Island in its entirety was being considered for nomination as part of the Boston Harbor Archaeological District. The MWRA concluded that the existence of cemeteries was not as significant as the existence of archaeological sites since the cemeteries could be moved and preserved elsewhere. Although the movement of graves raised implementation issues, those issues were the same for each island and were not considered to be impossible to overcome.

The MWRA also reviewed the potential eligibility of the Long Island Hospital, the Deer Island House of Correction, and the Deer Island pumping station for listing on the National Register of Historic Places.

Lastly, the MWRA reviewed the natural resources of the two islands. While little or no adverse impacts to the natural resources on Deer Island were found, with the exception of the removal of the drumlin on Deer Island in the case of a secondary treatment plant being sited there, it was determined that the wetlands and barrier beach at Long Island might be adversely affected by the construction of either a primary or secondary treatment plant even if strict controls were imposed. Concern was expressed that even a split secondary option would impact on sensitive areas on Long Island. In sum, the MWRA concluded that the least negative impact on natural resources would be achieved by selecting Deer Island for an all-secondary or all-primary wastewater treatment plant.

Mitigation Measures

The MWRA used the criterion of mitigation measures to focus on and clearly consider those actions which might be or ought to be taken with regard to a particular site to make that siting choice environmentally acceptable, and to assure to the greatest extent feasible that negative impacts from the siting selection would be alleviated or compensated for. The MWRA considered both environmental and non-environmental measures.

Environmental Mitigation. Environmental mitigation measures were considered to be those steps which would minimize adverse impacts from the construction and operation of the treatment plant.

Construction impact mitigation measures reviewed included barging, land modifications and buffers, scheduling and specifications for equipment to reduce noise impact, and monitoring and response mechanisms to oversee and enforce construction mitigation efforts.

Operations impact mitigation measures examined included the use of technology, design and buffers to reduce noise, odors and visual impacts on residences, institutions and/or recreators, as well as adaptation of site layouts and monitoring mechanisms to ensure proper operation and maintenance of the treatment plant and to assure responsiveness to changing conditions.

Most of the environmental mitigation measures were explored not only separately but as part of discussions involving reliability, effect on neighbors, cost, site layouts and effect on natural and cultural resources and are addressed to varying degrees under each of those topics in the FEIR. The MWRA articulated throughout these discussions a strong commitment to environmental mitigation, particularly as it would reduce negative impacts on the nearby receptors. It also recognized, however, that the extent of the mitigation employed would be determined, in part, by balancing the cost to the ratepayers against the degree of mitigation to be achieved. In some cases a determination was made that certain amounts or kinds of mitigation would be undertaken regardless of cost. For example, it was decided that stringent odor controls would be employed no matter where the treatment plant was constructed. It was

also determined that a significant degree of barging was required for the transportation of construction equipment and materials.

Most of the environmental impact measures considered were deemed applicable in some degree to all sites, but some measures were found to be required more frequently or to a greater degree under one site option or another. For example, the environmental mitigation measures to be employed when disturbing cultural or natural resources were perceived to be required more often and to entail more effort at Long Island than at Deer Island due to the greater number and value of sites located at Long Island. Balanced against this was the greater impact of noise on Deer Island neighbors and the resulting need for additional mitigative measures. The MWRA concluded that the individual environmental mitigation measures or the degree to which those measures might need to be applied differed from site option to site option but that, when all the mitigation measures for a particular site were totaled and balanced against all the mitigation measures required for another site selection, the environmental mitigation measures tended with one exception to balance out and not to be site-determinative. The exception pertained to the split plant options which would require the implementation of mitigation measures at two sites instead of one, with a substantial increase in cost. The MWRA considered this a factor to be weighed against selection of the split plant options.

The MWRA did decide that mitigation measures, while not being site-determinative between all Deer Island and all Long Island, were of critical importance with respect to whichever site it chose. Consequently, MWRA voted just prior to selecting its tentative preferred alternative site, that its FEIR for siting the Harbor Islands treatment plant should include a complete discussion of all practicable means and measures to minimize damage to the environment in connection with construction of the new sewage treatment facility including but not limited to (i) barging of construction material and personnel, (ii) limitations on unnecessary construction period traffic, (iii) controls on construction noise, (iv) controls on operating noise and odors, (v) visual enhancements of the site, (vi) alternatives to through-neighborhood trucking of chlorine for purposes of facility operations, (vii) construction of deep ocean outfalls, and (viii) development of compatible recreational uses on the site and elsewhere in Boston Harbor. The Board also voted on the day it made its tentative preferred alternative selection that it preferred that sludge management facilities be located off-site from the treatment facility.

Non-Environmental Mitigation. The MWRA considered non-environmental mitigation to be an important consideration in the siting decision and a necessary adjunct to the construction of a treatment plant of the size and complexity planned. Non-environmental mitigation measures examined were the opening of Shirley Gut, which would physically isolate Deer Island from the mainland, rehabilitating or reconstructing access bridges, development of recreational or other multi-use possibilities for the sites considered, protection against future facility overload, assurances of plant operating performance, employment of innovative technology, and relocation of the existing institutions. With respect to the measures reviewed, the ones determined to be site-specific were those concerning access bridges, opening of Shirley Gut, and relocation of the existing institutions.

As discussed in the text regarding the criterion of effect on neighbors, the MWRA evaluated the

comparative difficulty and cost regarding rehabilitation or replacement of access bridges and determined that it would be more costly to repair, replace or construct new bridges for access to Long Island.

After examination of the geologic processes and currents affecting Shirley Gut, the need for and high cost of maintenance to keep the Gut cleared, the numbers of regulatory requirements for undertaking such a project and the possibility that its being opened would result in greater nearshore pollution and perhaps permit movement of polluted waters from Boston Harbor through the gut to the eastern shores of Point Shirley and Winthrop, the MWRA determined that the opening of Shirley Gut was not a feasible mitigation measure and that other means of separating Deer Island from the mainland should be considered if a need for separation were determined necessary or desirable.

The relocation of the existing institutions was determined by the MWRA to be a critical non-environmental mitigation measure. This conclusion resulted from the MWRA's evaluation of: the effects of noise, odor and visual aspects of the treatment plant on the persons working in or inhabiting the institutions; the reduction in reliability which would result from construction of the treatment plant on sites constrained by the presence of the institutions; the far greater construction cost and ongoing maintenance and operational costs which would result from having to construct the treatment plant on a constrained site; and the greater recreational potential which would be available for the harbor if the institutions were removed. With respect to cost, recreational potential and the effects of noise, the MWRA concluded that it was even more important to relocate the House of Correction than the Long Island hospital, since the negative impact from retaining the existing institution on the same site as the treatment plant was greater for Deer Island than for Long Island. The MWRA also determined that while regional impacts would be more equitably distributed by the relocation of either institution, more equitable distribution would result from the relocation of the House of Correction due to the nature of the respective institutions and the number and kinds of regional impacts already experienced by the Town of Winthrop. The MWRA further noted that property values were more likely to be increased in the Town of Winthrop by the removal of the House of Correction than those in the City of Quincy by the removal of the hospital, and that the health and safety of residents of the Town of Winthrop were apt to benefit by the relocation of the House of Correction.

In sum, the MWRA concluded that if either Long Island or Deer Island were selected, the existing institutions should be relocated. As between the two islands, the MWRA decided that it was more important and more beneficial to remove the House of Correction if Deer Island were selected than it was to relocate the hospital if Long Island were selected. Some decision makers felt that if Deer Island were selected, the House of Correction must be relocated. For these decision makers, the relocation of the House of Correction was not a mitigation matter but an action compelled by the other criteria.

In evaluating the removal of the institutions, the MWRA placed strong emphasis on the implementability of such a measure. It received and considered commitments made by those authorities empowered to and responsible for any such relocation and determined that the implementability of relocating Deer Island House of Correction was extremely likely -- far more

likely than relocating the hospital.

As with environmental mitigation, the MWRA indicated its strong commitment to non-environmental mitigation by voting for the preparation of a complete discussion, for use by the Board of Directors, of proposed non-environmental mitigation measures for the construction of the Harbor Islands treatment plant including, but not limited to, construction workforce hiring preferences for residents of impacted communities, protection against diminished real estate values from nearby construction activities, preferential economic considerations for impacted communities, and funding for repair of bridges, roads or other physical infrastructure damaged by construction activities.

Criteria Weighing Process

The MWRA concluded that while all the criteria were important, some criteria were of relative equivalent value when applied to the various site options and were not site-determinative. Those criteria were: reliability, effects on neighbors, and implementability, as well as the environmental mitigation part of mitigation measures.

The five criteria which the MWRA concluded were site-determinative were: cost, equitable distribution of regional impacts, harbor enhancement, effect on natural and cultural resources, and non-environmental mitigation. All the site-determinative criteria except equitable distribution of regional impacts weighed in favor of selecting Deer Island as the site for the wastewater treatment plant. While the considerations of fairness implicit in the equitable distribution of regional impacts were valued very highly by the MWRA, they were not sufficient, by themselves, to outweigh the considerations of cost, harbor enhancement, effect on natural and cultural resources, and non-environmental mitigation measures.

In addition to determining which island should be the site for the construction of the Harbor Islands wastewater treatment plant, the MWRA concluded that whichever island was chosen, any existing institutions on that island should be removed. It based that conclusion on the results of applying the criteria of reliability, cost, harbor enhancement, effects on neighbors, and mitigation measures. Furthermore, the MWRA found on the basis of cost, equitable distribution of regional impacts, effects on neighbors (health and safety)*, harbor enhancement, implementability, and mitigation measures (non-environmental) that Deer Island without the House of Correction was the best site configuration considered. For some decision-makers, these latter criteria compelled the conclusion that if Deer Island were to be chosen as the site for the treatment plant, the House of Correction had to be removed.

* While health and safety issues originating from the construction and operation of a wastewater treatment plant were found not to be site-determinative, health and safety were considered to be enhanced by the removal of the House of Correction.

Tentative Selection

On July 9, 1985, on the day prior to its selection of a preferred alternative site, the MWRA voted its determination that the cost of a new wastewater treatment facility would be enhanced if the facility could be constructed on a site unrestricted by another existing institution, and that the removal of any existing conflicting institution would effectively serve to mitigate the impact of the location of a new wastewater treatment facility on surrounding communities.

In addition, the MWRA voted to direct its staff to work with any and all elected or appointed officials for the purpose of expediting the removal and relocation of any other institution located on whichever island it ultimately designated as the preferred alternative site for the new wastewater treatment facility. It further instructed its interim Executive Director to take certain actions to implement its position. The content of that vote is contained in Appendix B.

On July 10, 1985, the Board of Directors of the Massachusetts Water Resources Authority, in two separate votes, each ten to one, designated Deer Island as its preferred alternative for the siting of a new primary treatment wastewater treatment facility and as its preferred alternative for the siting of a new secondary treatment wastewater facility for Boston Harbor. The designations were explicitly undertaken for the purpose of completing final environmental and other precommencement review and to serve as the basis for undertaking only such additional work in the nature of planning, design, site assembly and any other work as can be accomplished prior to the availability of the Final Environmental Impact Report.

Final Selection

The following is the text of G.L.C. 30 Section 61, Findings by the MWRA on the Selection of Deer Island as the Site for Wastewater Treatment Facilities in Boston Harbor.

> On February 3, 1986, the MWRA made its final selection of a site for the proposed harbor island wastewater treatment plant. The selection of Deer Island as the location for the new facility brought to a close eight years of evaluation, discussion, comment and refinement of siting issues. Most of the history of the process followed and information explored is contained in the Supplemental Draft Environmental Impact Statement/Draft Environmental Impact Report (SDEIS/DEIR) and the MWRA's Final Environmental Impact Report on the Siting of Wastewater Treatment Facilities in Boston Harbor (FEIR).
>
> In particular, the latter document details the decision process engaged in by the MWRA from its inception in early 1985 through to its tentative selection of Deer Island as the site for the wastewater treatment facilities in July, 1985. Since July, the MWRA has continued to gather information which it has published in the FEIR, has received and evaluated comments to the FEIR including the Secretary's Certificate of Adequacy, and has reviewed EPA's Final Environmental Impact Statement and comments submitted on that document. Based on this information and on its previous examinations and evaluation, the MWRA has made its final selection. The following

sets forth the findings upon which that final site selection rests and the process by which it was completed.

DECISION PROCESS

In addition to its prior deliberations leading to the tentative selection of Deer Island as a site for the harbor island treatment plant, the MWRA evaluated two new categories of information in making its final siting selection. The first, technical information collected or refined between the July 1985, decision and the publication of the FEIR, was presented to and discussed by the MWRA Board of Directors at a series of public board meetings held throughout the fall of 1985. During these meetings, the MWRA reviewed and approved the content of the FEIR and adopted commitments to major mitigation measures contained in that document.

The second category of information reviewed by the MWRA was public and official comment to the FEIR, including the Certificate of Adequacy issued by the Secretary of the Executive Office of Environmental Affairs. In addition, the MWRA staff reviewed the Environmental Impact Statement issued by the Environmental Protection Agency and the Board of Directors reviewed the comments to that document as well as a summary of relevant distinctions between the FEIS and FEIR.

The information thus gathered was then evaluated for its applicability to the method of decision-making to be used in the final selection, for the effect of the information on the application of decision criteria to site options and for its effect on the mitigation measures to be adopted by the MWRA. A summary of that evaluation follows.

DECISION-MAKING METHOD

Selection of Criteria

The MWRA chose to maintain the eight criteria utilized in its tentative site selection process: Reliability, implementability, harbor enhancement, impacts on cultural and natural resources, costs, effects on neighbors, mitigation and equitable distribution of regional responsibilities. These criteria had been selected originally by the MWRA in response to the decision process carried out through the SDEIS/DEIR and the comments on that process. The Secretary of Environmental Affairs ("Secretary"), in his Certificate of Adequacy on the FEIR ("Certificate") approved the use of Equitable Distribution of Regional Responsibility as a means of assessing the more emotional, unquantifiable aspects of siting but opined that mitigation was better addressed only after a siting selection and not as a part of the siting decision process. As to the latter, the MWRA found that the use of mitigation as a criterion in arriving at a site selection had served a useful purpose and had contributed a focus different from the discussion of mitigation after a site was selected and that it was better to continue the decision process as already begun rather than making a major shift in the use of criteria at the culminating point in the decision process.

Weighing of Criteria

The Secretary's Certificate on the FEIR had recommended that each criterion be assigned a relative importance in the final decision. The MWRA reviewed the eight criteria selected and determined that they should be given equal weight as compared to each other.

Site Options

The MWRA, in reviewing the information gathered in light of the criteria utilized, found that a number of earlier determinations made in its tentative decision process should remain intact. Some of these determinations, once confirmed, served to eliminate certain site alternatives from consideration. For example, the MWRA confirmed its earlier tentative site decision that Nut Island was unacceptable for the construction of a treatment plant of the size contemplated, particularly with the filling of Quincy Bay which would be required. The Secretary's Certificate had acknowledged and found this conclusion to be acceptable, and other comments had only served to support this position.

The MWRA also confirmed its tentative decision that the four split plant options be rejected on the grounds that only the criteria of reliability and equitable distribution of regional impacts favored the selection of any of the split plant options, while the concerns encompassed in the remaining criteria were adversely affected by those alternatives. For example, the split island options would be more costly to construct, operate and maintain; would cause aggravated impacts to a wider universe of neighbors -- thus causing the need for greater mitigation; would be more difficult to implement because of the need to obtain approximately twice as many permits; and did not significantly lessen the impact of single island alternatives on cultural or natural resources or harbor enhancement. There was no additional or different information presented to persuade the MWRA to change this position.

As a result of these findings concerning site alternatives, the MWRA was left with a comparison of all Long Island and all Deer Island as possible sites for the harbor facility. A summary of the analysis of these two site alternatives in light of each of the criteria used and the information gathered as it affected those criteria, and the conclusions reached, follows.

APPLICATION OF DECISION CRITERIA TO THE ALL LONG ISLAND AND ALL DEER ISLAND SITE ALTERNATIVES

CRITERIA WITH NO SITE DETERMINATIVE EFFECT

In examining Long Island and Deer Island in light of the eight criteria, the MWRA found two criteria, reliability and effects on neighbors, to be of relatively equivalent value and therefore not to be site determinative.

Reliability

The MWRA had previously found reliability to be non-site determinative in its tentative decision because the size and configuration of each of the islands presented the same potential for use of design and layout to provide for reliability of the waste treatment system. The MWRA, in its current evaluation on reliability, noted that no new information had been presented to change that determination and confirmed its earlier decision.

Effects on Neighbors

The MWRA also found the effects on neighbors to be roughly equivalent between the two islands. As before, effects on neighbors were reviewed in six components: traffic impacts, noise impacts; odor impacts; visual impacts; property value impacts and safety impacts.

Traffic

Following its initial determination that the traffic impacts were comparable between the two sites, the MWRA commissioned a study to augment information provided in the SDEIS/DEIR traffic analysis. This analysis examined roadway conditions, assembled traffic counts, determined the present level of service on the roadways (LOS), and evaluated the impact of expected construction traffic. The MWRA concluded that for the predicted level of construction related traffic there was sufficient roadway capacity leading to each site during peak hours and that the impact although somewhat worse at some intersections for access to Long Island, was relatively comparable.

The MWRA also further explored the feasibility of barging, identifying the types of barging and/or water transportation that might be needed and sites that could be utilized. The MWRA made commitments to a level of barging, to caps on construction-related traffic and to busing of workers, all of which is set out in the Commitments to Mitigation section below.

The MWRA reviewed traffic-related comments received on the FEIR. The MWRA concluded, based on its original evaluation and the additional traffic information and comments collected since its tentative decision and its strong commitment to mitigation measures, that the traffic impacts remained roughly equal and did not favor either island.

Noise

The MWRA, in its tentative decision, adopted the then current position of EPA that noise levels at Deer Island would result in greater impact to neighbors, particularly the close neighbors at the House of Correction. However, that position was predicated on EPA's view that Long Island as a site for the treatment plant could not contain the Long Island hospital whereas the Deer Island site could encompass the House of Correction.

The MWRA in its final selection compared the sites equally, i.e. both sites with existing

institutions and both sites without those institutions. The MWRA concluded that when the sites without institutions were compared, there was more noise impact on neighbors at Deer Island than at Long Island. If the sites were compared with the institutions present, then the severity of impact on the residents or workers at each institution was equivalent.

To explore whether noise levels at Deer Island could be kept at acceptable levels, the MWRA retained an acoustical consultant to evaluate expected noise levels during both construction and plant operation for the Deer Island site. The consultant also furnished information to the Board on existing acoustical conditions, applicable regulations and an evaluation of the expected effectiveness of noise mitigation measures.

The MWRA concluded that for the nearest residence the noise levels from both construction and operation were within applicable legal standards. Furthermore, during the daytime the projected noise would be indistinguishable as compared to the existing ambient levels. At night, with a minimum of construction to be anticipated, nighttime noise would not be an impact. During plant operation, if power was generated on-site, a slight increase in background levels over existing levels was determined to be likely.

Based on this information and upon review and assessment of comments on noise, the MWRA concluded that while noise impacts upon receptors other than the current institutions would be greater at Deer Island, those impacts could be maintained at acceptable levels. The MWRA also found that the noise impacts at Deer Island prison or Long Island Hospital, because of the proximity of those institutions, would raise the noise levels above the legal standard and would require extraordinary mitigation measures to be adopted.

<u>Odor</u>

Odor studies conducted on behalf of the EPA have indicated that potential odor impacts on neighbors are comparable, regardless of plant location. This confirmed the MWRA's tentative decision that the issue of odor was not site determinative. The MWRA further recognized that odor control was a paramount concern and that stringent odor controls would be utilized no matter where the treatment plant was located. As a result of further work presented since its tentative selection, the MWRA concluded that control stystems such as wet scrubbers and carbon absorption columns would likely be effective in controlling the odors. The MWRA confirmed its tentative decision that odor impacts were not site determinative and committed itself to a limit of no detectable odor off-site as well as a goal of no objectionable odor on-site.

<u>Property Values</u>

Reviewing trends in real estate values and the impacts of other noxious facilities on property values, the MWRA confirmed its tentative decision that the effect on property values, to the extent that that effect could be predicted, was not site-determinative.

Visual Impacts

In its tentative decision the MWRA determined that a treatment plant on either island have a negative impact on persons in the existing institutions due to proximity. With respect to residential neighbors, it was determined that if the institutions remained, there would be a somewhat greater negative impact from a treatment plant on Deer Island. If the House of Correction were removed, however, modifying land forms and landscaping could be used to screen the treatment plant from most residences.

Health and Safety

Health and safety concerns of the community -- such as traffic impacts on schools and the elderly, chlorine delivery, air quality reduction from traffic or the facility operation -- were examined and found once again not to be site-determinative factors.

Summary of the Effects on Neighbors

Most of the effects considered within each of the subcategories of effects on neighbors were found to be roughly equivalent between Long Island and Deer Island. For those two categories in which a somewhat more negative impact was discerned for Deer Island, noise and visual impact, the degree of difference in impact was not sufficient to change the balance of effects on neighbors between the two sites.

SITE DETERMINATIVE CRITERIA

The MWRA found the remaining six criteria to have a site-determinative effect. Five of the criteria favored the selection of Deer Island while one criterion, equitable distribution of regional responsibilities, favored the selection of Long Island. A summary of that analysis follows.

Equitable Distribution of Regional Responsibility

Just as in its tentative decision, the MWRA found in its final site selection that this criterion favored the selection of Long Island over Deer Island. The impacts of other regional uses such as Logan Airport, Deer Island House of Correction and the current Deer Island treatment plant were found to have greater impact on Deer Island neighbors than the airport and other regional facilities had on Long Island neighbors. The MWRA concluded that it was more unfair to site the harbor facility at Deer Island.

Cost

The MWRA again found this criterion to favor selection of Deer Island. There was no change to the cost information upon which the MWRA had made its tentative decision. Those figures still showed the construction of a treatment plant on Deer Island to be less costly than a facility at Long Island. While noting that EPA had found this criterion to

be non-site determinative and that the Town of Winthrop had concurred with this conclusion, the MWRA recognized that this reflected a value judgment by the EPA and Winthrop of the relative unimportance of the dollar difference which both EPA and MWRA agreed existed rather than different information as to the cost figures themselves. The MWRA, as the operator of the system felt that the difference in cost between the two sites was of site significant importance.

Implementability

In its tentative decision, the MWRA found implementability to be non-site determinative. The information which the MWRA had reviewed at that time covered the permitting and land acquisition issues and, based on the assessment that the numbers and types and timing considerations of permits and approvals were generally the same, had concluded that the criterion was relatively equivalent between the sites. The MWRA also noted at that time that the removal of the House of Correction from Deer Island was far more implementable than the removal of the hospital from Long Island due to the expressed support for the former by those in a position to effect the removal.

Two factors have been added to the implementability discussion since the tentative decision, however, which have caused the MWRA to change its conclusion about this criterion. The first is the concurrence in the approval by the Secretary of the selection of Deer Island as the site for the treatment plant. The second is the selection of Deer Island by the EPA as its preferred alternative. The choice of Deer Island as the preferred site by both a state regulator and a federal regulator, each of which has responsibilities in further permitting or approvals concerning the construction and operation of the treatment plant and related facilities, increased the likelihood of successful and expeditious processing of the many regulatory reviews and permits pertaining to the Deer Island site. It also suggests a facilitating of the disposition of federal land located on Deer Island. In light of these factors, the MWRA has found in its final siting decision that implementability is no longer non-site determinative and that it weighs in favor of selecting Deer Island.

Harbor Enhancement

A further exploration into recreational potential of Deer Island conducted during the tentative decision process was completed for the FEIR and confirmed what had already been suggested during the tentative decision process: that a greater potential existed for Deer Island than had been suggested in the SDEIS/DEIR. However, the possibility of this greater potential had been discussed when the MWRA made its tentative selection and its confirmation did not change the MWRA's determination that harbor/enhancement favored siting the treatment plant at Deer Island. The MWRA still found that Long Island's recreational resources included natural and undeveloped aspects which could not be recreated if lost; that Long Island as a park could be brought to reality sooner since it did not have sited on it both a prison and a current treatment plant which had to continue operating until the new plant was on line; that there were indications that official support and dollars had already been or could readily be mobilized to make a park on Long

Island a reality; and, finally, that the adverse visual impact on the harbor was greater from a treatment plant on Long Island because of the Island's position in the harbor and its configuration.

Effect on Natural and Cultural Resources

In examining the natural and cultural resources of each island, the MWRA took into consideration additional pieces of information received since its tentative decision. In particular, the MWRA considered the results of a study, which it had commissioned, of parts of Deer Island which had never been adequately evaluated before for the existence of archaeological or historical resources. That study confirmed the existence of a cementery in the northeastern part of the island and also confirmed the potential eligibility of the Deer Island pump station and portions of the Deer Island House of Correction complex for nomination to the National Register. Subsequently, the Massachusetts Historical Commission found that the pump station, and two buildings in the prison complex met National Register criteria. In its comments on the FEIS, the Commission also noted that Long Island in its entirety had been nominated to the National Register as a component of the Boston Harbor Islands Archaeological District, that the Long Island hospital complex also met National Register criteria of eligibility and that historic burial grounds existed on Long Island.

All the information received concerning these resources was a confirmation of material already considered to be potentially true during the MWRA's tentative decision. The MWRA found, as it had in its tentative selection, that Long Island possessed more resources and more unique resources than Deer Island and that these resources, particularly the unique resources, would be adversely impacted by the siting of the harbor treatment plant facility on Long Island.

The MWRA noted that EPA had found this criterion to be non-site determinative but recognized that EPA had hypothesized layouts which could avoid these resources without fully exploring the technical feasibility of those layouts. The MWRA had assured that the layouts upon which their conclusions rested were technically feasible.

Mitigation

The MWRA utilized the criterion of mitigation to focus on and clearly consider those actions which might be or ought to be taken with regard to a particular site to make it more acceptable. The utilization of this criterion in the siting decision process brought to the fore and highlighted mitigation measures which might be site specific and permitted the MWRA to weigh the need for those measures in its siting selection. Early analysis of mitigation needs during the decision process also laid the groundwork for a thorough understanding and appreciation of mitigation measures to be adopted once a site was chosen. The mitigation measures to which the MWRA finally committed itself in the implementation of its site selection of Deer Island are contained in the Commitments to Mitigation section which follows.

With respect to the effect of the mitigation criterion in the siting selection process, the MWRA confirmed its earlier finding that mitigation favored the selection of Deer Island.

While various measures to mitigate construction and operation impacts such as noise and odor or the destruction of natural or cultural resources might shift the balance slightly toward one site or the other within each of those categories, the total number of kinds and degree of mitigation required for one site or the other tended, with one exception, to balance out roughly equal as a whole. The one exception was the mitigation measure of relocating the existing institutions. The MWRA found in its tentative decision and confirmed in its final decision that it was critical to relocate whichever existing institution was located on the chosen site due to the adverse environmental effects which accrued from constructing the treatment plant on a constrained site in close proximity to the particular institution. However, the MWRA also found that there was more net benefit to building the treatment plant on Deer Island and removing the House of Correction than building on Long Island and removing the Long Island Hospital since removal of the House of Correction would favorably affect property values and the safety of the surrounding community and would promote equitable distribution of regional facilities. Further details as to the findings of the MWRA regarding the removal of the existing institutions and the Deer Island House of Correction in particular is contained in the Commitments to Mitigation section which follows.

Final Siting Decision

Having found two criteria effectively neutral between Long Island and Deer Island (Reliability and Effects on Neighbors), one criterion favoring the selection of Long Island (Equitable Distribution of Regional Responsibility) and five criteria favoring selection of Deer Island (Cost, Implementability, Harbor Enhancement, Effects on Natural and Cultural Resources and Mitigation), and having given each criterion equal weight, the MWRA determined that the most appropriate site for the harbor island wastewater treatment facility is Deer Island.

COMMITMENTS TO MITIGATION

Recongizing the need to adopt all feasible measures to mitigate the adverse environmental impacts, the MWRA, as part of the FEIR, set forth a series of mitigation commitments designed to alleviate the impacts associated with the construction and operation of the Deer Island plant. During the process of making its final siting decision the MWRA reviewed the public comments on the proposed mitigation commitments and the comments received from the Secretary of Environmental Affairs and adopted a final series of mitigation commitments. This section sets out those commitments.

--Commitments on Flow and Growth
--Commitments on Plant Maintenance
--Commitments on Odor Control

--Commitments on Noise
--Commitments on Barging
--Commitments on the Use of Liquid Chlorine
--Commitments on the Relocation of the Deer Island House of Correction

Commitments on Flow and Growth

Recognizing the need for responsible management and being sensitive to the possible need for expansion of the proposed Deer Island treatment plant, the MWRA has made the following commitments with respect to flow and growth:

- o The MWRA will undertake all necessary and prudent planning and management initiatives to avoid overloading the Deer Island treatment plant.

- o The MWRA will not expand the treatment plant capacity unless or until it has implemented flow management techniques and has developed and implemented a program to avoid excess pollutant loading. These techniques and programs include:

    - Conducting infiltration/inflow reduction programs

    - Instituting water conservation programs that can reduce wastewater flows

    - Pricing of water and sewer services to promote the conservation of water, thus reducing wastewater flows

    - Controlling pollutant loads through pricing strategies and pretreatment programs

    - Controlling both flow and loads through regulatory controls, such as flow reduction programs to compensate for new connections

    - The MWRA will develop monitoring and triggering programs so that it will be able to test the effectiveness of the flow management techniques and to provide the MWRA with the ability to determine when planning for the MWRA's next increment of treatment capacity should be undertaken

- o If the MWRA determines, through its monitoring and triggering programs, that the flows and loading are increasing at rates higher than projected in the FEIR, it will take all necessary steps to plan, design, and construct ancillary facilities including (but not limited to):

    - Flow control structures, such as on-line and off-line storage to minimize peak flows at the plant

    - Septage treatment facilities to reduce pollutant loadings on the Deer Island plant

- o If the ancillary facilities are insufficient to accommodate increased flow and loading and to prevent exceeding the design capacity of the Deer Island treatment plant, the MWRA will take all necessary steps to plan, design, and construct satellite treatment plants unless it determines it would be economically or environmentally infeasible to do so.

- o Notwithstanding the foregoing, the MWRA does not intend the adoption of the above commitments to require the postponement or cancellation of any capital program contained in the Authority's Fiscal Year 1986-88 capital budget that services to eliminate an existing problem of sewage backups.

The purpose of these commitments is to confirm the MWRA's desire to establish a sound and rational program for assessing future capacity needs, to respond to public concerns on overloading and future system expansion, and to provide a framework within which additional capacity will be planned.

<u>Commitments to Operation and Maintenance</u>

MWRA has already made clear its commitment to improved operations and maintenance by approving both a substantially increased operating budget and by authorizing significant increases in operations and maintenance staff for existing facilities. MWRA's commitment to maintenance is underscored by their adoption of the following assurances:

- o <u>Review of Recurrent Budgets.</u> Annual operating budgets will be carefully scrutinized to be certain that these budgets reflect not only a sound maintenance program for existing facilities but that the budgets reflect any new facilities expected to be in service during the budget year. The MWRA will link budget expenditures with performance indicators that reflect the efficiency and effectiveness of the maintenance programs.

- o <u>Renewal/Replacement Expenditures.</u> More than $100 million in construction projects have been initiated at the Nut Island and Deer Island treatment plants to replace much of the antiquated equipment at these plants. These upgraded programs are expected to be completed in 1989 and will contribute significantly to the reliability of the existing plant equipment. Capital budgets in future years will continue to reflect the important role that R/R plays in the maintenance of treatment facilities. The MWRA's maintenance procedures will be modified at an early date to incorporate record keeping procedures that will provide a rational basis for R/R investment in future years.

- o <u>Review of Maintenance Procedures.</u> Prior to the completion of the on-going upgrade program, the MWRA will initiate a review of its existing maintenance procedures. Strengthened maintenance procedures will be designed including an aggressive housekeeping and preventive maintenance program. These procedures will be amended as new treatment facilities are constructed.

- o Initiate Early Planning. To ensure that operations and maintenance considerations are included as an integral part of the planning for all new facilities. MWRA will require that the plant's facilities plan include a preliminary plan of operations. The preliminary plan of operations will identify the additional or unique O & M requirements of the recommended facilities, including staffing and special training needs, manuals, special tools and workshops, and estimated budget considerations. This preliminary plan of operations will provide MWRA with two to four years' lead time prior to completion of facilities to incorporate the maintenance requirements of new facilities into on-going maintenance programs.

- o Adoption of Performance Indicators. MWRA will adopt performance indicators into the agency's proposed management information systems that will permit the Authority to review on a regular basis the level-of-effort and the performance of the maintenance activities. Indicators such as plant performance, equipment availability, maintenance labor/expenditures, custodial inspection reports, spare parts inventory, and equipment age will be monitored to regularly examine the efficiency of the maintenance efforts. Additionally, the Authority will involve the community in reviewing maintenance programs to provide focus on issues of local importance.

Commitments on Odor Control

The MWRA commits to the construction of the treatment pant that will control odors so as to eliminate detectable odors off-site and to control odors as necessary to protect the public health. Furthermore, the MWRA commits to the control of odors so as to minimize, to the maximum extent feasible, objectionable odors on-site.

The type of odor control needed will be selected during the facility planning effort. Sampling of the odor potential characteristics of the influent wastewater will be conducted as part of the facilities planning to provide the necessary data to develop a program of source control and to size and select the odor control equipment.

The most reliable means of measuring odor performances is the human nose. In order to measure the plant odor performance, an odor panel will be created composed of individuals from the community as well as individuals from the MWRA. The panel will routinely monitor for odors to ensure that no objectionable odors are occurring off-site. The panel will also respond to odor complaints received by the plant, by assisting in the investigation of the odor and recommending odor control techniques.

Commitments on Noise Control

The MWRA is committed to complying with all the legal standards of both City of Boston noise control ordinance and the Department of Environmental Quality Engineering.

Because of the scale of the proposed plant, however, the MWRA is setting as a goal noise abatement that goes beyond simply adhering to the City of Boston code. The MWRA has

attempted to define, by the FEIR, what noise levels may be achievable and will examine means of noise abatement throughout the planning, design and operation of the facility.

The MWRA further commits to the development of a program for avoiding adverse noise impacts, the components of which shall be resolved during facilities planning but which shall include the following:

- o The establishment of an Acoustical Review Board. The Acoustical Review Board will include representatives from the community as well as engineers and MWRA staff.
- o The use of available and feasible noise control techniques, which may include items such as the evaluation of the acoustical characteristics of operational equipment and flexible scheduling of construction activities to minimize noise.
- o The establishment of necessary training and hiring practices to assume the best possible control of noise impacts.
- o The involvement of the community in the development of noise control programs and the participation of community representatives in those programs.

Commitment on Barging and Busing

The determination that barging and busing are necessary is a direct consequence of the volume of traffic associated with the construction of the proposed facility and the limited capacity of roadways leading to the plant site. The Traffic section of the FEIR describes the capacity of the roadways. The commitment to barging, therefore, also requires a commitment to maximum traffic levels associated with the construction of the plant. Those traffic levels are defined for both the pier construction period and for the period thereafter.

Prior to construction of the piers, it is not feasible to barge materials to the site. Therefore, the MWRA has prioritized the identification of barge sites, design of pier facilities and construction of those piers. The Authority is engaged in the selection of a consultant for the necessary barge and pier facilities. The MWRA commits to limiting the trucking of materials for construction of the piers to a maximum of 20 trucks per day.

Upon completion of the pier facilities, the barging of almost all heavy construction equipment and materials is, based on the analyses conducted to date, an achievable level of barging. The level of commitment is conditioned, however, to allow for contingencies that may result from scheduling or operational problems. The extent of such contingency trucking, after the completion of the piers, will be limited to a service fleet of eight trucks. Also, in order to minimize impacts associated with commuting of construction workers to the plant site, the Authority has committed to the busing of all workers, using a maximum of 28 buses per day.

In addition, the Authority will undertake an evaluation of the practicality of providing

ferries to transport construction workers to the job site.

Commitments on the Trucking of Liquid Chlorine

The MWRA has committed to cease the trucking of liquid chlorine through the streets of Winthrop as soon as possible upon access facilities becoming operable and the transport of alternate disinfectant or barging of liquid chlorine being feasible.

Commitment on Relocation of the Deer Island House of Correction

The MWRA has determined that the Deer Island House of Correction must be relocated from Deer Island by those parties with jurisdiction over its operation and that such relocation must be deemed a mandatory mitigation measure.

The MWRA's conclusion with respect to this mitigation measure is based on its findings throughout the tentative and final site decision process relative to the environmental impacts resulting from the construction of the harbor island treatment plant on either island with the existing institutions present, and the benefit to be gained by the removal of the existing institution from the island selected as the site for the treatment plant. Many of those findings, as they relate to Deer Island were addressed by the Secretary in his Certificate as well as by numerous commentors to the FEIR, all of whom found the relocation of the prison to be a required mitigation measure. The MWRA's findings on benefits which would result from relocation of the prison are summarized as follows.

The MWRA found that the reliability of the treatment plant would be greatly enhanced by providing sufficient space for optional design. The converse was also found, that building on Deer Island with the prison present would require a cramped design with reduced space between piping and flow controllers resulting in decreased uniformity of flow and reduced control over the treatment process. This, in turn, would increase the possibility of operational malfunctions or decrease the ability to monitor or redress such episodes, resulting in adverse impacts on neighbors of the treatment plant.

The MWRA also found that building the treatment plant in such close proximity to the prison would cause severe visual and noise impacts on the persons living and working in that institution. The noise impacts on the prison would be above the legal standard and would require extraordinary mitigation measures to be undertaken to ameliorate the effect. Mitigation measures, such as buffers or berms, would place additional area demands on an already constrained site. Other measures, such as timing and placement of construction and equipment could adversely impact the length of construction time. Removal of the prison would eliminate such impacts and the need for such mitigation measures.

Relocation of the prison would also reduce costs. The cost of constructing the treatment plant on a constrained site with the prison present, of operating and maintaining the plant under those conditions, and of providing the necessary mitigation measures to alleviate the proximity of the treatment plant to the prison would be significantly greater than building without the prison.

Finally, additional benefits to recreators and to non-prison receptors would accrue from the removal of the prison. Those benefits would include alleviating the visual impact of the treatment plant on Winthrop receptors by providing space for screening and modifying landforms, providing space for recreational and open land use, reducing traffic on Winthrop's streets by the approximately 114 autos a day currently used at the prison, substantially alleviating the combined impact of regional facilities on the Town of Winthrop and by enhancing the safety of the community.

For all these reasons and the reasons cited by the Secretary, some of which are echoed by other commentors, the MWRA finds the removal of the Deer Island House of Correction to be a mandatory mitigation measure.

Further Measures to be Examined

The commitments to mitigation listed above comport with all mitigation measures which would be required under the MEPA statute. In fact, in many instances, as noted by the Secretary in his certificate on the FEIR, the MWRA has addressed many issues to a far greater degree than was required and has made commitments in these areas accordingly.

Nevertheless, the Secretary, in his final Certificate, has made recommendations that certain measures be undertaken either sooner than might be required or with respect to current facilities as opposed to the new treatment plant which is the subject of the FEIR.

The MWRA considers these suggestions positive and worthy of serious review. It has directed staff to evaluate the Secretary's suggestions and to recommend within thirty to ninety days where, when and how they may be responded to and the nature of the recommended response. The suggestions by the Secretary include:

1. The "Sewer Bank" concept be further explored and feasible programs developed to eliminate excess flow and accommodate new connections.

2. Accommodate major growth within the service area through satellite plants.

3. Continued and strengthened programs to monitor flows to provide sound data to gauge the effects of flow management.

4. Implement odor panel and formal odor complaint response at existing facility.

5. Consider real time monitoring of odors, perhaps using hydrogen sulfide as an indicator.

6. Consider development and implementation of a monitoring program for VOCs and other air toxics in the wastewater stream and in the ambient air.

7. Recommend implementation of an acoustic Review Board to monitor and respond to

noise complaints at existing facility: and supplement such a noise program now and at the new treatment plant with periodic noise monitoring.

Summary of Impacts and Findings of Limitation of Impacts

The MWRA finds that the environmental impacts resulting from the construction of the Boston Harbor wastewater treatment facility are those impacts as described in the Draft Environmental Impact Report, elaborated on and refined in the Final Environmental Impact Report and commented upon in these G.L.C. 30, Section 61 Findings.

The MWRA further finds that its selection of Deer Island as the site for the wastewater treatment facility, and its commitment to the mitigation measure set out in the Commitments to Mitigation section of these G.L.C. 30, Section 61 Findings constitute all feasible measures to avoid or minimize the environmental impacts described.

Record of Decision

The text of EPA Region I's Record of Decision on the Final Environmental Impact Statement Siting of Wastewater Treatment Facilities for Boston Harbor is as follows:

The U.S. Enviromental Protection Agency (EPA) has prepared this document as its Record of Decision (ROD) for the Final Environmental Impact Statement (FEIS) on the siting of the Massachusetts Water Resources Authority (MWRA) wastewater treatment faciities which will abate the pollution of Boston Harbor.

The MWRA has the responsibility of selecting the site for the wastewater treatment facilities. EPA's primary responsibilities are to conduct an evaluation of environmental acceptability under the National Environmental Policy Act (NEPA), provide federal financial assistance if available, and ensure rapid compliance with the Clean Water Act.

EPA issued a Supplemental Draft EIS (SDEIS) in December, 1984 and a FEIS on December 2, 1985 on the siting of wastewater treatment facilities for Boston Harbor. These documents evaluated the environmental impacts of various site options for facilities to treat Greater Boston's wastewater in compliance with water pollution control laws. The SDEIS also served as a Draft Environmental Impact Report (DEIR) under the provisions of the Massachusetts Environmental Policy Act (MEPA) for the Metropolitan District Commission (MDC). Since publication of this joint document, the sewer functions of the MDC have been reorganized into the MWRA. The Board of Directors of the MWRA chose to follow an independent but parallel decision process and to publish a separate but concurrent Final Environmental Impact Report (FEIR) under state law.

Following the concurrent publication of EPA's FEIS and MWRA's FEIR, EPA and MWRA conducted joint public hearings before reaching their respective final decisions. Public hearings were held on January 13, 14 and 15, 1986 in Quincy, Boston and Winthrop. Oral and written comments were submitted during the comment period. The public comment period ended on January 21, 1986 for the FEIS and January 24, 1986 for the FEIR.

In February, 1986, the MWRA determined that "the most appropriate site for the harbor island wastewater treatment facility is Deer Island." This ROD identifies EPA's final decision on the siting issue. This ROD is being circulated to inform the public of this decision and to respond to the comments on the FEIS.

I. EPA's FINAL DECISION ON THE SITING OF SECONDARY WASTEWATER TREATMENT FACILITIES FOR BOSTON HARBOR

With the understanding that EPA will require the MWRA to carry out the program of specified mitigation measures identified on pages 52-55 of the FEIS, Volume I, EPA's decision is that its preferred alternative is the All Secondary Deer Island alternative set forth in the EIS and described below. All Secondary Long (without the hospital) is also environmentally acceptable and is preferred over Split Secondary Deer-Long (without the hospital). The only alternative which EPA finds unacceptable is Split Secondary Deer-Nut. The decision process and the program of required mitigation measures is described in more detail in Section III.

EPA's preferred alternative for secondary treatment, All Secondary Deer, would expand the existing primary wastewater treatment facility at Deer Island to a secondary treatment plant. It would reduce the existing primary treatment facilities at Nut Island to a small headworks. It would include construction of a major new pipeline or tunnel from Nut Island to Deer Island and of an effluent outfall to the east of Deer Island Light. The existing wastewater treatment facility on Deer Island would be increased from 26 acres to about 115-140 acres while on Nut Island the existing wastewater facility would be reduced from 12 acres to about 2 acres.

This alternative would commit almost all the land on Deer Island south of the existing prison to wastewater treatment and level the most prominent topographic features of the island. This alternative would also require the construction of a bulk materials loading pier(s) and roll-on roll-off facilities at the site, and associated terminal(s) on-shore.

The estimated construction cost of this alternative would be about $1.135 billion and its annual cost of operation, maintenance and replacement would be about $50 million. Costs, acreage requirements, exact plant layout and mitigation measures will be developed in greater detail during further facilities planning on the project.

<u>The Benefits of Moving the Prison</u>

The MWRA favors a variation of the All Secondary Deer Island alternative which assumes that the prison would be removed as a mitigation action, and that its site would be made available for the treatment plant. This variation would also use most of the Island but prison removal would reduce the impacts of the treatment plant in several ways:

1. It would remove the receptor population (the prison workers and inmates most

affected by the plant's impacts, including noise and odor.

2. It would eliminate prison-related traffic, thus offsetting construction-related and operations traffic for the treatment plant.

3. It would improve the appearance of Deer Island by removing the prison buildings.

4. It would permit opportunities for sculpting the landscape to a more natural appearance and for screening the facility from both the harbor and Point Shirley and Cottage Hill in Winthrop.

5. It would increase the opportunity for buffering noise at Point Shirley by earthen barriers on prison property.

6. It would permit the retention of a portion of the Island's shoreline for buffering and recreation.

7. It would remove prison-related anxieties from Winthrop.

8. It would make more land available for the wastewater treatment facility, possibly making construction and maintenance easier.

This variation does not eliminate the need for any of the mitigating actions proposed for the All Secondary Deer Island alternative with the prison to remain, except for those intended to reduce impacts at the prison itself, e.g., a noise barrier.

However, the process required to release the Deer Island prison site for treatment plant use could be so lengthy as to delay or frustrate the construction of this variation of the All Secondary Deer Island alternative. EPA has long advocated removal of the prison if Deer Island is to be the treatment plant site, but EPA will not require removal of the prison as a grant condition. Implementation of secondary treatment is required by the Clean Water Act and cannot be made dependent upon removal of the prison if the site is acceptable.

This ROD concludes that in EPA's judgement the All Secondary Deer Island Alternative is its preferred alternative and can be implemented without unacceptable environmental impacts even if the prison remains.*

II. SELECTION OF ALTERNATIVES FOR EVALUATION

Federal regulations require EPA, during environmental review, rigorously to explore all reasonable alternatives for the siting of wastewater treatment facilities for Boston Harbor. Most of the alternatives initially investigated were derived from the EPA's 1978 Draft Environmental Impact Statement (DEIS), which examined only secondary treatment options, and the MDC's 1982 Nut Island Site Options Study. The Site Options Study identified eleven alternatives (eight secondary and three primary treatment alternatives), including some previously examined in the DEIS. In September, 1983, EPA and the Commonwealth conducted two public scoping meetings to receive comments on these initial alternatives from the public and from federal, state and local officials. Upon completion of the joint scoping meetings, EPA selected eleven additional alternatives for analysis, for a total of twenty-two alternatives to be studied. These included twenty alternatives for treatment at Deer, Long, Nut, or man-made islands and two alternatives including sub-regional "satellite" plants. A complete discussion of the twenty-two initial primary and secondary alternatives appears in the SDEIS at Vol II, Section 12.12. Table I is a complete list of the twenty-two initial options.

[See Table I on page 3-38 of this volume.]

III. DECISION PROCESS

To examine such a large number of alternatives, a screening process was developed jointly with the Commonwealth. Its objective was to narrow the number of alternatives being investigated and to eliminate those that clearly offered few benefits or had significant adverse impacts. This initial screening of alternatives is summarized here; it is described in detail the SDEIS. Each alternative's economic, social and environmental impacts were studied. In addition, their technical, legal, institutional and political problems were also analyzed. Specific criteria were developed for comparison and screening of the options.

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* The Clean Water Act requires that wastewater treatment plants be constructed which will provide "secondary" treatment unless EPA, under strict statutory guidance, grants a waiver, under Section 301(h) of the Clean Water Act, permitting a lesser "primary" degree of treatment with a deep ocean dicharge. EPA has twice denied the MDC/MWRA request for such a waiver but final rights of appeal have not expired. EPA believes it is highly unlikely any such appeal, even if pursued, would prevail on the merits, or that the discharge of primary effluent into Massachusetts Bay would ultimately be permitted over the opposition of the Governor and other officials. However, in the interest of completing the NEPA review, EPA has decided in this ROD to resolve the siting of a primary treatment plant as well. The decision is the All Primary Deer Island alternative.

TABLE I

LIST OF TWENTY-TWO INITIAL OPTIONS STUDIED IN THE SDEIS

Secondary Treatment Alternatives

1a.1 Secondary Treatment at Deer Island. Headworks at Nut Island with separate North and South System Secondary Treatment Processes.

1a.2 Secondary Treatment at Deer Island. Headworks at Nut Island with combined North and South System Secondary Treatment Processes.

1b.1 Secondary Treatment at Deer Island. Primary Treatment at Nut Island for South system, separate North and South System Secondary Treatment Processes.

1b.2 Secondary Treatment at Deer Island. Primary Treatment at Nut Island for South System, combined North and South System Secondary Treatment Processes.

1c Secondary Treatment at Deer Island for North System. Secondary Treatment at Nut Island for South System.

2a.1 Secondary Treatment at Deer Island for North System. Secondary Treatment at Long Island for South System. Headworks at Nut Island.

2a.2 Secondary Treatment at Deer Island for North System. Secondary Treatment at Long Island for South System. Primary Treatment at Nut Island.

2b.1 Headworks at Deer Island for North System. Headworks at Nut Island for South System, Consolidated Secondary Treatment at Long Island.

2b.2 Primary Treatment at Deer Island for North System. Primary at Nut Island. Consolidated Secondary Treatment at Long Island.

2b.3 Headworks at Nut Island. Primary Treatment at Deer Island for North System. Consolidated Secondary Treatment at Long Island.

3a Headworks at Deer and Nut Islands. Consolidated Secondary Treatment at Lovell's Island.

3b Headworks at Deer and Nut Islands. Consolidated Secondary Treatment at a new man-made island.

Primary Treatment Alternatives

4a.1 Primary Treatment of All System at Deer Island. Headworks at Nut Island. Local Outfalls.

4a.2 Primary Treatment of All System at Deer Island. Headworks at Nut Island. Deep Ocean Outfalls.

4b.1 Primary Treatment at Deer Island for North System. Primary Treatment at Nut Island for South System. Local Outfalls.

4b.2 Primary Treatment at Deer Island for North System, Primary Treatment at Nut Island for South System, Deep Ocean Outfalls.

5a.1 Primary Treatment at Deer Island for North System, Primary Treatment at Long Island for South System, Headworks at Nut Island. Local Outfalls.

5a.2 Primary Treatment at Deer Island for North System, Primary Treatment at Long Island for South System, Headworks at Nut Island. Deep-Ocean Outfalls.

5b.1 Headworks at Deer and Nut Islands, Consolidated Primary Treatment at Long Island. Local Outfalls.

5b.2 Headworks at Deer and Nut Islands, Consolidated Primary Treatment at Long Island. Deep-Ocean Outfalls.

Satellite options 1&2 - Satellite facilities for South System with discharge to Charles and Neponset Rivers. Satellite facilities for South System with wetlands discharge.

(End of Table I)

In screening the initial alternatives, it became clear that no alternative was without some potentially adverse impacts. Furthermore, no alternative satisfied all of the criteria used in the analysis. Considering the size and complexity of the project, virtually all alternatives were considered to have at least one or more drawbacks that limited their acceptability to some affected group(s).

The initial screening process concluded that of the twenty-two alternatives studied, four secondary treatment options and four primary options conformed to these criteria and warranted further investigation and more detailed study. These alternatives reflected different approaches to the siting requirements of the MDC system. The impacts of these options also varied in their respective advantages and disadvantages. The eight alternatives are identified below according to their abbreviated names used in the EIS. (Parenthetical references in Table I refer to the nomenclature used in the initial screening process.)

a. Secondary Treatment (Harbor Entrance Outfall) Alternatives:

1. All Secondary Deer Island (1a.2)

2. Split Secondary Deer Island and Nut Island (1b.2)

3. All Secondary Long Island (2b.1)

4. Split Secondary Deer Island and Long Island (2b.3)

b. Primary Treatment (Nine Mile Outfall) Alternatives:

1. All Primary Deer Island (4a.2)

2. Split Primary Deer Island and Nut Island (4b.2)

3. All Primary Long Island (5b.2)*

4. Split Primary Deer Island and Long Island (5a.2)

A detailed assessment of the impacts of these alternatives was provided in the SDEIS.

During the further preparation of the SDEIS, relevant Massachusetts agencies and the EPA agreed that it was necessary to refine the decision process because of the complexity of the siting decision and the great number and variety of factors which must be taken into account by decision-makers. The first step was to re-analyze the various arguments and considerations that had been brought to bear on this controversial siting decision by all concerned parties in order to determine their disparate objectives. These objectives were used to develop a more precise set of decision criteria against which the remaining alternatives were to be evaluated. It was the goal of the SDEIS to make the list short, yet inclusive of all concerns that had been raised. Six decision criteria were identified. Each alternative was to be evaluated to determine the extent to which it:

1. is consistent with and, if possible, promotes the fulfillment of the promise of Boston Harbor. (Harbor Vision)

2. can be implemented in a timely and predictable manner. (Implementability)

3. minimizes the adverse impacts of the facility on neighbors, taking into consideration existing conditions, facility siting impacts and mitigation measures. (Effects on Neighbors)

4. minimizes the impacts of the facilities on natural and cultural resources. (Impact on Cultural and Natural Resources)

5. can be built and operated at a reasonable cost. (Cost)

6. maximizes the reliability of the entire treatment system. (Reliability)

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* Though the SDEIS/EIR suggested that one alternative, All Primary Long, should also be screened out and not receive further active consideration, the SDEIS/EIR and the FEIS contained a full evaluation of All Primary Long. EPA considers that all eight alternatives received an equal level of analysis.

Finally, EPA and the Commonwealth developed a comprehensive program of mandatory measures applicable to all alternatives: barging of materials, busing of workers, and noise and odor control.

Thus, in the SDEIS/EIR, EPA and the Commonwealth had narrowed the options remaining for secondary or primary treatment from twenty-two to eight alternatives, but had not arrived at a statement of two preferred alternatives, one for secondary treatment and one for primary treatment. The most important factor leading to this outcome was a desire on the part of both EPA and the Commonwealth to encourage public scrutiny and obtain formal public comment on the results of initial screening process, the large amount of new data, the new decision criteria and the proposed mandatory mitigation before proceeding to suggest two preferred alternatives.

After the close of the SDEIS/EIR public comment period, in light of the high degree of public acceptance, EPA decided to retain criteria as a way to impose order on a mass of detail in this especially complex review, and to focus on those impacts which are relevant to the choice of a site. EPA also reviewed all the public comments submitted to identify both those criteria-relevant issues which needed futher analysis prior to selection of a preferred alternative and those other issues which related to the overall project or were otherwise not criteria-relevant, but which were appropriate for inclusion in the FEIS or the FEIR. EPA performed additional analyses on potentially site-relevent topics.

EPA and the MWRA agreed that it was appropriate for each to pursue an independent decision-making process under their respective statuatory mandates but to do so in parallel and with a high degree of coordination. Accordingly, to ensure that both agencies shared a common data base, as either agency identified data needs or developed information, it was shared with the other by exchange of technical memoranda and through technical presentations at meetings with EPA's Technical Advisory Group or with the MWRA's Board of Directors or staff.

EPA systematically reviewed its entire data base using the decision criteria and evaluated each piece of data in terms of one or more of the appropriate decision criteria. EPA felt that each decision criterion was legitimate and was confident that sufficient objective data existed to permit a reasoned judgement as to the acceptability of the alternative sites.

Mandatory Mitigation Measures

Upon the completion of the review of each decision criterion, the assumed level of mandatory mitigation as set forth in the SDEIS/EIR was either confirmed or, if appropriate, modified as the result of further technical information. EPA found that the most critical need for mitigation was to reduce impact on neighbors. EPA applied a set of specific mandatory mitigation measures to all alternative sites except as noted below. The mandatory mitigation measures can be summarized as follows:

. Barging of bulk materials to and from the site to reduce the amount of trucking through affected communities during construction:

. Use of a roll-on/roll-off barge loading facility at the site and at an onshore transfer station to accommodate heavy trucking;

. Busing and ferrying of construction workers to reduce commuter traffic in affected communities during the construction period;

. Use of "maximum feasible degree" of odor control and investigation of state-of-the-art odor control technology;

. A ban on the use of liquid chlorine at Deer Island unless there is "clear and convincing" need for it and proof that it can be handled without unnecessary risk to neighbors, including the prison workers and inmates;

. Implementation of noise control measures during construction, including the excavation of the Deer Island drumlin from the south side so that the remaining mass of the drumlin acts as a shield, and construction of a sound barrier at the Deer Island prison.

. Prohibition against trucking liquid chlorine to Deer Island as soon as piers and staging areas are available to commence over-water transport;

. Exploration of alternatives to the use of liquid chlorine at the treatment plant and at the associated headworks;

. Sampling of volatile organic compounds downwind from the existing primary plants at Deer and Nut Islands, exploration of technologies to control these compounds and installation of appropriate controls if necessry;

. Exploration of alternative treatment processes that might be less space demanding, less costly, or more reliable than secondary treatment based on the activated sludge process;

. Exploration of the feasibility of developing recreational uses of the site along with the treatment plant;

. Control of dust, erosion and sedimentation.

For a detailed statement of the mandatory mitigation measures, see pages 52-55 of the FEIS Volume I. Each of these mitigating efforts will be the subject of detailed study by the MWRA as further facilities planning explores these ways of achieving acceptable levels of impact. EPA, after appropriate environmental review, is prepared to modify these mitigation measures if equally effective protection can be achieved by other methods.

In the judgement of EPA, these stringent mandatory mitigation measures include all practicable means which are necessary and appropriate to avoid or minimize environmental harm from the alternative selected. EPA acknowledges that in some cases its mitigation package differs from the mitigation commitments described in the MWRA's FEIR and its findings under Section 61 of MEPA. EPA is confident, however, that its mandatory mitigation measures would result in an extraordinary degree of mitigation which would effectively minimize environmental harm.

Final Analysis*

During the final analysis, it became clear that three of the decision criteria, through theoretically important, no longer played site-distinguishing roles.

1. On "Cost", a more detailed analysis revealed that the costs of the four alternatives were so close that EPA decided to regard this decision criterion as having neutral effect.

2. On "Reliability", each of the sites permitted treatment plants of equal reliability.

3. On "Impact on Cultural and Natural Resources", though this decision criterion included federally protected resources (wetlands, barrier beaches, recognized historical and archeological sites, etc.), the impact of plants on either Deer or Long Island would be essentially equal and acceptable. On Nut Island, however, the Split Secondary Deer-Nut Alternative would involve the serious impacts of filling of tidal areas (unless homes were taken) and this was taken into account in the final decision.

Thus, "Effects on Neighbors", "Harbor Vision" and "Implementability" remained as the principal decision criteria for EPA. EPA felt each of these three criteria represented protection of important public values of substantial weight and each will be discussed below:

1. With respect to the "Effects on Neighbors" decision criterion, should the "no prison" variation of the All Secondary Deer Island alternative be implemented, EPA concluded that a treatment plant at either Deer Island or Long Island would have acceptable and essentially equal impacts on its neighbors, with the mandatory mitigation measures in place. However, if the prison were to remain on Deer Island, EPA concluded

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* In the following discussion it is important to note that, in the SDEIS/EIR, EPA and the Commonwealth concluded that under both Long Island alternatives, the Long Island hospital must be relocated off-island in order to avoid unacceptable impacts to "Effects on Neighbors", "Harbor Vision" and "Cultural and Natural Resources". EPA believes this conclusion remains valid.

that a plant site on Deer Island would have a greater effect on its neighbors than a site on Long Island, but these impacts as mitigated were acceptable. EPA felt that removal of the prison was desirable but not mandatory. EPA also concluded that the mandatory mitigation reduced the impacts so substantially that the plant could be constructed without unacceptable impact despite the presence of the airport and the prison.

The Split Secondary Deer-Long alternative would involve major construction activity of approximately the same perceived effect on the neighbors of each island as if the entire plant were being constructed there. Though those effects were found to be acceptable, it was felt to be unwise to impact two sets of neighbors unless there would be some benefit to another decision criterion; there was not.

Split Secondary Deer-Nut imposed severe burdens on its immediate neighbors on Hough's Neck without any corresponding benefit to Deer Island and Point Shirely. It was found to be environmentally unacceptable.

2. Considering only the "Harbor Vision" decision criterion, EPA concluded that though all four altenratives were acceptable, the All Secondary Deer alternative was preferred under "Harbor Vision". EPA believes that Deer Island's size, topography and setting give it acceptable long-term potential for rehabilitation as a park resource. However, because of Long Island's current potential as a major island park, EPA did conclude that while both All Secondary Deer and All Secondary Long satisfied the Harbor Vision decision criteria, All Secondary Deer satisfied it better.

Less acceptable were the other two alternatives. Though Split Secondary Deer-Long preserved significant potential recreation space at each island, EPA agreed with the Commonwealth that an entire island as park was preferable. Split Secondary Deer-Nut committed Nut Island to wastewater treatment without any corresponding benefit at Deer Island; though Nut Island has not been a major part of a harbor park plan, it could provide locally important open space.

3. Considering only the "Implementability" decision criterion, the following issues were of principal importance: permits and licenses, and the attitudes of the City of Boston and agencies and legislature of the Commonwealth. Even prior to the July 10, 1985, vote of the MWRA selecting All Secondary Deer Island as its tentative preferred alternative, EPA had concluded that the "Implementability" decision criterion pointed to All Secondary Deer with or without the prison because the principal remaining alternative, All Secondary Long (without the hospital), faced significant opposition. However, EPA was concerned that Deer Island prison removal was uncertain.

The July 10, 1985, and February, 1986 votes, and the MEPA Sec. 61 Findings of the MWRA, the proposing agency, which has the statutory authority to build the treatment plant and which controls much of Deer Island, confirmed EPA's conclusion that the All Secondary Deer alternative was clearly more implementable than any of the other alternatives.

The Governor's continued support of the MWRA, his renewed commitment to facilitate

relocation of the prison, and his new offer to identify a new prison site by May, 1986, further supports this result. Other officials have reiterated their support for prison removal if Deer Island is to be the site. As stated by the Secretary of Environmental Affairs in his Certificate on the FEIR, Janury 21, 1986:

> "...[T]hrough the joint struggle of all branches of government, the courts, the press, and the public, important milestones have now been passed - the creation of the Authority and public consensus on siting. A momentum has now built up, which I consider so powerful that the cleanup cannot and will not be stopped. The joint will of Mayor Flynn, Governor Dukakis, the General Court and our citizens is so strong that I am convinced the difficulties of prison relocation can be overcome...". (emphasis added)

EPA agrees with the MWRA that the reinforced support of relevant public officials for Deer Island prison removal and the continued opposition to Long Island Hospital removal makes prison removal "far more feasible" than hospital removal.

Furthermore, even if the prison were to remain, EPA notes the continued strong opposition of the city and state officials who control the future of Long Island to any use of Long Island as a treatment plant and notes their reiterated support for a Long Island park and for a continued role for the Long Island Hospital and Homeless Shelter.

Therefore, EPA confirms its previous judgement that All Secondary Deer Island (even if the prison were to remain) is more implementable than either of the other two environmentally acceptable alternatives: All Secondary Long and Split Secondary Deer-Long (both without the hospital).

In summary, with mandatory mitigation,

1. EPA found Split Deer-Nut to be environmentally unacceptable because of its severe impact on its "Neighbors" at Nut Island and on "Natural Resources", and strong barriers to "Implementability".

2. EPA found Split Deer-Long (without the hospital) to be environmentally acceptable; but EPA also found it to be undesirable because it spreads impacts on "Neighbors" and "Harbor Vision" to two islands without any benefit deemed valuable to a decision criterion. It also was unlikely to be "Implemented".

3. EPA found both All Secondary Long (without the hospital) and All Secondary Deer to have an acceptable impact on "Neighbors" and "Harbor Vision".
   a. "Neighbors". With mitigation, the impact of a Deer Island plant on its "Neighbors" is either equal to (without the prison) or worse than (with the prison) a Long Island plant.

b. "Harbor Vision". The impact of a Deer Island plant on the public benefits from and uses of Boston Harbor causes somewhat less harm than a Long Island plant.

c. "Implementability". Between these two acceptable and closely balanced alternatives, building a treatment plant on Deer Island (with or without the prison) is clearly more "Implementable" than building a Long Island Plant.

EPA's decision based on the foregoing analysis is that its preferred alternative is All Secondary Deer with mandatory mitigation. The FEIS contains more information on the decision process.

IV. IMPLEMENTATION, MONITORING, ENFORCEMENT OF MITIGATION MEASURES

Applicable regulations require EPA, in this ROD, to adopt and summarize an implementation, monitoring and enforcement program for its mitigation measures.

EPA's first implementation, monitoring and enforcement mechanism will be through the construction grants program. Section 201(g) of the Clean Water Act authorizes the Administrator to grant financial assistance to municipalities for the construction of municipal wastewater treatment plants. Section 511(c) of the Act states that the award of a construction grant may be considered a major federal action significantly affecting the quality of the human environment, subject to the requirements of NEPA. These statutes give EPA the authority to enforce the mandatory measures through the federal construction grants program. The mandatory mitigation measures for the selected site at Deer Island will be made necessary conditions of any Federal construction grants awarded to the MWRA during the Step 3 Construction Phase of this project.

EPA has determined, pursuant to Section IV B 7 of the 1984 Construction Grants Delegation Agreement and 40 CFR Section 3015(c), that an overriding federal interest exists in this project, in particular in regard to the implementation of the mandatory mitigation program specified in the FEIS. In order to ensure that all mandatory mitigation measures are implemented through the construction grants program, the agency will play a direct role in oversight of facilities planning, design and construction of the wastewater treatment plant including piers, outfalls and pipelines/tunnels. The specific role that EPA plans to play will be at least as follows:

. review all sections of all the facilities plans to ensure compliance with the mandatory mitigation program as set forth in FEIS Volume I, p.53-55.

. coordinate with the Massachusetts Department of Environmental Quality Engineering (DEQE), Division of Water Pollution Control in reviewing the plan of study for the facilities plans.

. participate in any technical and citizen advisory committees as part of the public participation program for the facilities plans.

. participate in the review of the draft products of the facilities plans, particularly the development of the mandatory mitigation measures.

. EPA will review at least the specfics of the proposed odor control program, noise control program and possible volatile organic compound emissions control program to ensure that MWRA is achieving effective impact reductions required by this ROD. On the issue of liquid chlorine use, EPA will ensure in its review of the facilities plan that MWRA has undertaken a thorough disinfectant alternatives analysis. On the issue of busing, ferrying and barging, EPA will monitor the development of the facilities planning investigations to ensure that MWRA establishes the required programs to mitigate transportation impacts.

. coordinate with DEQE for joint reveiw and approval of the final facilities plans. The facilities plans will be approved only upon successful development of the mitigation program as outlined in the FEIS.

. EPA will request the Army Corps of Engineers, during construction, to make periodic onsite reviews to ensure that the project is being managed properly, is on schedule, and is being constructed in accordance with approved construction drawings and specifications including mitigation measures and change orders.

In order to facilitate a high degree of review oversight by EPA, the agency intends to enter into an agreement with the DEQE Division of Water Pollution Control and MWRA to outline further details of EPA's oversight.

In addition to EPA oversight and participation in further facilities planning, EPA intends to assume primary responsibility for NEPA review by the preparation of any environmental assessments or supplemental EIS's determined to be necessary in connection with these activities. EPA and the Army Corps of Engineers plan to enter into a Memorandum of Understanding in order to minimize delays in any environmental reviews involving both agencies.

Second, the MWRA is under federal court order to initiate facilities plans for the shore-side piers and staging areas, on-site piers and staging areas, outfalls and tunnels or piplines. The MEPA unit of the Executive Office of Environmental Affairs has made the determination that EIR's will be prepared on these facilities plans. In addition, the facilities plans will include EID's which provide environmental evaluations of the final facilities plan components. EPA will conduct an independent environmental review, under NEPA, of these facilities plans, except for those aspects of the wastewater treatment plant covered by this EIS.

Third, in the unlikely event that federal funding for this project were to be totally unavailable due to the termination of the Construction Grants Program, this project will require other federal actions which bring it within NEPA. These include the transfer of surplus federal lands by the General Services Administration (GSA); permit actions by the Corps of Engineers for the construction of piers and the disposal of dredged material or fill; and possible permit actions by EPA for the ocean disposal of fill. Each of these actions triggers independent opportunities to implement and enforce the mitigation program. For example, GSA intends to dispose of the surplus property in accordance with the FEIS and has committed to incorporate the mandatory mitigation measures into its own Record of Decision as appropriate.

Fourth, this project is now the subject of a federal court action (United States of America v. Metropolitan District Commission, et al., Civil Action No. 85-0489 D.C. MA and a related case.) In the event of the cessation of the construction grants program, EPA will also consider seeking an order of the federal court mandating that the mitigation program laid out in the FEIS be implemented.

Fifth, it should also be noted that the MWRA has committed to the Commonwealth that it will undertake a set of mitigation measures which are, with the exception of prison removal, substantively equivalent to those required by EPA. These are contained in the Section 61 Findings of the MWRA to the Secretary of Environmental Affairs under the MEPA.

[See Section 3.2 Siting Decision, Subsection Final Selection in this Volume.]

FURTHER ENVIRONMENTAL REVIEW UNDER NEPA

EPA expects that further environmental review under NEPA relating to the cleanup of Boston Harbor will include appropriate study of the following phases of the process, including cumulative impacts:

1. Long-term residuals management, including the processing, transport and ultimate disposal of sludge. Scoping for this EIS has already commenced.

2. The construction of pier(s) and staging area(s) at the treatment plant site and on shore to allow for barging of bulk contruction materials, equipment, and work crews during construction, and possible transport of sludge. In the event that an existing pier cannot be located on the mainland, an additional pier or piers and staging area(s) would need to be constructed there.

3. The construction of an under-harbor tunnel or pipeline to transport wastewater to the treatment plant.

4. The water quality and construction impacts of an outfall pipe or pipes through which effluent will be discharged.

5. The possible disposal of earthen or dredge materials which might need to be removed from the site of the secondary treatment plant prior to construction.

6. The possible transport, handling, storage, and use of chlorine at the secondary treatment plant, depending upon the outcome of studies by MWRA regarding the environmental acceptability of its transport, handling, storage and use.

7. Combined sewer overflow projects.

CONCLUSION

EPA has engaged in a decision process which gathers technical information, exposed it to extensive public scrutiny, developed very stringent mitigation measures, and evaluated the alternatives in terms of disclosed decision criteria. EPA believes this open process has arrived at a fair and reasonable conclusion that the upgraded treatment plant, considered singly or in combination with other conditions, will be constructed and operated with acceptable environmental results.

3.3 RELATED PROJECTS

Projects

Although the Secondary Treatment Facilities Plan is the beginning of the key project in the Boston Harbor Cleanup Program, there is a long list of projects that are being planned, designed or are under construction to upgrade and expand the MWRA's wastewater collection and treatment capabilities. These projects are grouped into the following programs:

- Industrial Waste
- Treatment Plant Upgrade
  - Nut Island Immediate Upgrade
  - Deer Island Fast Track Improvementss
- Interim Residuals Management
  - Interim Sludge Processing and Disposal
  - Interim Scum Management
- Long-Term Residuals Management
- Water Transportation Facilities
- Combined Sewer Overflows
- Harbor Research and Monitoring

In addition to the above wastewater programs, several waterworks projects have either a direct or an indirect bearing on the secondary treatment facilities planning. MWRA has also initiated several projects to strengthen its ability to direct and manage its extensive capital program and its extensive day-to-day operational responsibilities. The projects designed to strengthen MWRA's institutional capability are described in Volume VII, Institutional Considerations. The

related wastewater programs are described briefly in the following paragraphs.

Industrial Waste Program

In February of 1973, MWRA's Industrial Waste Program began to acquire data on all industries within the 43 cities and towns which comprise the sewerage district. This program has become the means whereby the Authority enforces Federal, State and MWRA regulations which govern the discharge of wastewater to the sewer system. The goals of the enforcement strategy are to decrease and control pollution loads to the treatment works; increase safety for maintenance and operational personnel; reduce illegal waste discharges such as extraneous water and septage from non-member municipalities; and prosecute for willful damage or vandalism.

The Industrial Waste Program, which was approved by the EPA in July of 1982, is being implemented in four phases: Inspections, Monitoring, Permitting and Enforcement.

Inspection Activities

The inspection program includes on-site inspection of all indusries in the district. It requires a discussion period with appropriate plant personnel to ascertain the type of activity being performed at the facility, the raw materials used, products and services produced, and the particular processes and unit operations employed. A tour of the facility is also conducted to verify the information received. Industries suspected of discharging a questionable waste are required to submit the results of laboratory analyses, performed on representative samples of the process waste by an independent laboratory, for review and evaluation by the Authority. The results of analyses, along with other pertinent information (permit application, inspection reports) on the industry, are used to determine whether or not the wastes are in compliance with the MWRA's Rules and Regulations. A permit application must be completed by all users discharging industrial wastes.

An intensified Industrial Inspection Program has commenced as a result of the increase in staff and resources. In Fiscal Year 1987, approximately 425 industrial inspections were conducted.

Septage Disposal Inspection Program

The Septage Disposal Inspection Program is basically divided into two activities: first is the oversight of the septage control activities of the member municipalities with septage receiving locations; and second is surveillance of each septage receiving location to determine compliance with MWRA Rules and Regulations and to identify any illegal septage dumping.

Each member municipality which operates or has designated a septage receiving station is responsible for the control and monitoring of all activities at the septage receiving location. The Water Quality Section evaluates control procedures at each septage receiving location for the purpose of determining the municipality's ability to control the dumping of septage from non-member communities, to prevent the discharge of industrial or toxic wastes, and to verify the origin of all septage receiving at each septage receiving location.

In some instances the possibility of illegal or uncontrolled dumping at certain septage receiving locations is suspected. In response to these instances, surveillance of the septage receiving site is conducted in order to document septage disposal, and possibly identify illegal dumping activities requiring enforcement of dumping restrictions.

Identification of I/I and Surcharging During Routine Investigations

In adddition to identifying sources of toxic discharges to the sanitary sewer system, investigations at industrial facilities often identify the illegal discharge of "clean" water, also known as inflow. During these industrial investigations the most common form of inflow uncovered is non-contact, uncontaminated cooling water and non-contact, uncontaminated industrial process water.

In addition to identifying these and other sources of inflow, inspection personnel often identify excessive use of water and make recommendations to limit water use. These recommendations serve to reduce the flow in the already overloaded sewer system, which helps to minimize surcharging.

Monitoring Activities

The Monitoring Section of the Water Quality Department continually participates in a variety of activities, the most significant being monitoring for the Industrial Waste Pretreatment Program. More specialized areas of monitoring include sampling at the Treatment Plants, fulfilling NPDES Permit monitoring requirements, soil sampling, beach sampling, and verification of discharges and connections. Monitoring activities during Fiscal Year 1987 numbered 565, compared to 200 in Fiscal Year 1986.

Collection of industrial waste samples from industries discharging into the Authority Sewer System yields a profile of industrial wastes currently entering the system and provides the basis for enforcement to eliminate unacceptable concentrations of toxic and potentially harmful substances. The samples collected are forwarded to a laboratory for analysis, where strict Quality Assurance/Quality Control procedures are employed. Analytical results from this monitoring, in conjunction with information derived from inspecting and permitting activities, assist in determining the acceptability of the discharge and whether enforcement action is warranted.

The Monitoring Team has been involved in site assessment and the implementation of the monitoring program to fulfill the NPDES Permit requirements. The permit requires monitoring at Deer and Nut Island Treatment Plants and at three Combined Sewer Overflow (CSO) facilities (Cottage Farm Chlorination and Detention Station, Charles River Estuary CSO Treatment Facility, Somerville Marginal CSO Pretreatment Facility). At the treatment plants, samples are taken monthly for parameters not monitored daily by the plants, such as organics, metals and cyanide.

Beach sampling has been frequently requested in response to reports of odor problems and unidentified growths or discharges into the harbor.

Other monitoring activities include sampling soil or sludge to determine the degree of contamination to assist in proper disposal decisions, verification of discharges and connections via dye tests and researching sewer line maps, groundwater sampling, and sampling at construction or cleanup sites before discharge to the sanitary sewer system.

Municipal Permits/Sewer Use Discharge Permits

Sewer Use Discharge Permits are issued to each sewer user discharging industrial wastes located in the Authority Sewer District regardless of size, type or volume of discharge. For permitting purposes, the Sewerage Division has classified users into four categories according to the nature of their wastes. The categories are as follows:

1. Industries requiring pretreatment.
2. Industries having some toxic discharges but at concentrations which do not require pretreatment.
3. Industres which have non-toxic discharge in addition to sanitary flow.
4. Dry industries or industries with sanitary flow only.

Sewer Use Discharge Permits are revised as new information is received. At present, much of the activity involving permits is due to revisions and renewals, which are done on a daily basis.

Compliance and Enforcement

The Authority has been extremely successful in working with its Sewer Users in a cooperative spirit to eliminate existing or potential discharge problems, since the inception of the Industrial Waste Program. Over the years, thousands of industries and other sewer users have been inspected, monitored and issued permits. Through the inspection, monitoring and permit phases of the Water Quality Department's Industrial Waste Program, many of these industries were found to be in violation of acceptable discharge practices. Any continued violations of permit conditions or Sewer Use Rules and Regulations will result in enforcement actions to assure compliance with acceptable discharge practices. New Sewer Use Rules and Regulations promulgated May 1, 1987 have broadened the scope of MWRA enforcement powers, including rights to:

1. Issue an order to cease and desist any such discharge violations;

2. Direct a User to submit a detailed schedule, subject to such modifications as the Authority deems necessary, setting forth actions to be taken to correct or prevent a violation;

3. Issue an implementation schedule ordering specific actions and a time schedule;

4. Revoke, modify or deny a permit issued to the User by the Authority;

5. Impose administrative penalties up to $10.000 per day of continued violation. and seek payment for damages to its system pursuant to 360 CMR 10.105 and 360 CMR 2.00;

6. Bring a civil or criminal action as provided by law;/ or

7. Take any other action available to it under federal. state or local law or regulation.

In cases where significant resistance is given to the Authority's discharge regulations, enforcement actions have been initiated. Enforcement actions to date range from informal meetings with the offending companies to legal actions taken through the Office of the Attorney General of the Commonwealth of Massachusetts. The results have been civil penalties ranging upward of $600.000 and agreements for judgements mandating adherence to strict compliance schedules.

The Authority's newly promulgated Administrative Penalty Regulations and Rules for Adjudicatory Proceedings will enable the Water Quality Department to be more effective in enforcement. The Authority is also establishing firmer policy and procedures which will be followed for the imposition of Civil Penalties in those future cases which require the assessment of fines.

Treatment Plant Upgrade Programs

Both the existing Deer Island and Nut Island Treatment Plants are being upgraded to extend the useful life of the installed facilities until the new treatment facilities can be constructed and placed into operation.

The Nut Island Immediate Upgrade Project began in January. 1983 and is expected to be completed in May. 1988. Eight projects costing approximately $12 million have been initiated to extend the useful life of the Nut Island Plant approximately ten years. Table 3.3-1 summarizes the eight immediate upgrade projects. Table 3.3-1 also describes other projects that are planned or underway to rehabilitate the existing treatment plant.

The Deer Island Treatment Plant Fast Track Improvementss Program consists of several projects to raise the operating efficiency of the existing plant to an acceptable level. The construction of these upgrading projects started in June. 1986 and is expected to be completed in March, 1990. The Deer Island Fast Track Improvements Program is summarized in Table 3.3-2. Other projects that are expected to improve the service life of the existing facilities on Deer Island are also described in Table 3.3-2. These rehabilitation projects also include upgrading the remote headworks facilities which function as an integral part of the Deer Island Treatment Facilities.

TABLE 3.3-1
NUT ISLAND IMMEDIATE UPGRADE

- Power
  - Rebuilding of one engine generator
  - Installation of 2000 kw transformer for purchased off-site power to the site
- Preliminary Treatment
  - Addition of influent flow meter (sonic type) on the High Level Sewer
  - Installation of new ventilation system, odor control equipment, and explosion-proof electrical components to the grit facility
  - Removal of comminutors downstream from the grit chambers
  - Rebuilding of the effluent channels from the grit tanks
  - Replacement of air header to the preaeration basins
  - Rebuilding of one preaeration blower motor
- Primary Sedimentation
  - Structural rebuilding of tanks and repairing of leaks
  - Levelling of tank floors
  - Replacement of all weirs
  - Replacement of sludge collection equipment
- Digesters
  - Replacement of outside sludge piping from the primary sludge pumps to the anaerobic digesters
  - Digester roof rehabilitation
- Outfalls
  - Installation of an automated sluice gate at the outfall
  - Cleaning of the two main outfalls
- Electrical Distribution Substation Replacement
- Sewerage Pump Switchgear Replacement

TABLE 3.3-2

DEER ISLAND TREATMENT
FACILITY
FAST TRACK IMPROVEMENTS

- Pump Station and Power Station Improvements

  - 5 new 90 mgd influent sewage pumps
  - 4 new 2000 Hp electric motors
  - New graphic control center to monitor sewage flow
  - New cooling water system for engines
  - New pumps for process water building
  - New heating system process water building
  - 2 new 6000 kw dual fuel. engine/generator sets
  - New switch gear/electrical distribution center
  - New fuel storage system for engines

- Rehabilitation of Digesters
  - 4 new floating roofs
  - New internal digester piping
  - New gas meters at each digester
  - New waste gas burners with meters
  - 6 new spiral heat exchangers
  - 4 new sludge hot water pumps
  - 1 new boiler
  - Rehabilitation of 2 Ingersoll-Rand gas compressors
  - A new heating and ventilating system for both the sludge thickener and the digester complexes
  - A gas detection system for both complexes

- Sludge Thickener Improvements

  - Remove existing tank mechanisms
  - Remove existing bridges, pumps and associated piping
  - Install new thickener mechanisms and bridges
  - Install new sludge transfer system, pumps and compressors
  - Install associated piping, electrical and control instrumentation

- Primary Sedimentation Basins Improvements

  - New grit collection system
  - New grit classification building
  - New scum concentration building

Table 3.3-2 (cont'd)

- New chemical feed building
- Influent and effluent sampling stations
- 80 new motorized influent sluice gates and 80 stainless steel baffles
- New flow splitter plate, to equalize grit distribution
- Structural repairs to the sedimentation basins and bridges
- 48 new stainless steel aeration leaders and diffusers
- 3 new air compressors for the aeration channels

o Chlorine Rehabilitation

- 8 new evaporators
- 8 new chlorinators
- 2 new scale systems
- New HVAC system
- New roof
- New piping and distribution system for chlorine and process water

o Electrical Upgrade

- 4 new electrical distribution substations
- New conduit for substations
- New motor control centers throughout Deer Island

o Dual Fuel/Generator Overhaul

- Overhaul of 5 diesel enginers 1000 Hp
- Overhaul of 4-700 kw generators

o Deer Island Remote Headworks Improvements (Columbus Park, Chelsea Creek and Ward Street)

- New grit collection and removal equipment for all 12 channels (four at each facility)
- New climber-type mechanical screens
- New HVAC equipment
- New odor control equipment
- Improvements to electrical systems
- Monorails, hoists and bridge cranes
- Hydraulic power units for sluice gates

o Winthrop Terminal Headworks Improvements

- Three climber-type mechanically cleaned bar screens
- Grit collection equipment

Table 3.3-2 (cont'd)

- Three inlet sluice gate operators and hydraulic power system
- Overhaul six sewage pumps (4-16,00 gpm and 2-32,000 gpm)
- Six new drive motors and controls
- Screening discharge enclosure
- Two stair access/egress towers

Interim Residuals Management Program

The Interim Residuals Management Program is intended to provide the facilities necessary to cease the discharge of sludge to the ocean by 1991. MWRA is presently soliciting proposals from private firms to provide land based disposal of sludge until the long term management facilities now being planned are constructed in 1995. The Interim Residuals Management Program includes sludge from both the Deer Island and the Nut Island Treatment Plants.

A second component of the Interim Residuals Management Plan is interim scum management. Scum is the floatable material that is skimmed from the surface of sedimentation facilities at both treatment plants. Scum is currently mixed with the sludge and discharged to the harbor. Because these materials are the more obnoxious and visible discharged to the harbor, the removal of these materials has been given the highest of priorities. For the interim period at Nut Island, scum screening, chemical conditioning and landfill disposal was selected as the recommended scum handling option. Design of these facilities was initiated in May, 1987. At Deer Island, the recommended plan for termination of scum discharges involves a one year demonstration project. This project includes chemical fixation of all Deer Island scum by a private contractor with storage on-island. Initiation of this period is anticipated in November, 1987. At the end of the one year demonstration, a decision will be made to build permanent facilities or to continue with a service contract.

A third component of the interim residuals management plan is a composting pilot plant. Composting stabilizes organic materials and destroys bacteria and viruses in sludge. Composted sludge has the potential for use as a soil supplement for production of turf grass, horticultural uses at green houses, use as a low-grade fertilizer or use as a landfill cover material. The pilot plant was initiated in 1984 and currently processes fifteen dry tons per day of sludge. The pilot plant serves the dual purpose of reducing the quantity of sludge discharged to the harbor and at the same time provides a compost product to test and develop a market for the material in the greater Boston area. The compost pilot also provides valuable information for the assessment of the viability of composting as a long-term residuals management option.

Long-Term Residuals Management Facilities Plan

The facilities planning for the long term management of residual solids is being conducted concurrently with this planning effort. The planning effort includes assessment of the quantity and quality of Deer Island and Nut Island sludge, survey of available sludge processing and transport technologies, selection of appropriate technologies, screening of potential disposal sites and selection of optimum facilities and sites. Design and construction will include both on-island and mainland facilities. The facilities planning is scheduled for completion in 1988. Figure 3.3-1 illustrates the general flow of planning activities for the residuals management facilities plan.

Water Transportation Facilities

The Water Transportation Program includes the construction of the piers and related facilities to move materials, workers and equipment to and from Deer Island for the construction of the new treatment facilities and at Nut Island to support construction of the new headworks facility. Facilities planning for both on-island and on-shore piers is essentially complete. On-island piers are now being designed. Construction of these essential facilities is expected to commence in March, 1988 and be completed in September, 1989. Construction of the on-shore piers is expected to start in September, 1988 and be completed in May, 1990. See Figure 3.3-2 for a schedule of water transportation facilities planning.

Combined Sewer Overflow Program

MWRA is currently evaluating a means of abating pollution from combined sewer overflows. Figure 3.3-3 denotes the overall facilities planning for the CSO program.

Harbor Research and Monitoring

The ultimate goal of this project is the design and implementation of a plan for action directed towards cleaning up Boston Harbor and protecting the Harbor in the future.

A Technical Advisory Group (TAG), established in 1986, produced a "Study Plan for Basinwide Management of the Boston Harbor/Massachusetts Bay Ecosystem". This plan defined the goals for research and monitoring in Boston Harbor and Massachusetts Bay that will be closely tied to management issues. The study plan further identified many issues facing environmental managers. Of these issues, five have been identified as high priority, requiring a well-focused scientific study.

MWRA plans to participate in a joint public and private effort to establish a Harbor monitoring and research program. The program will conduct research that will report on existing conditions and measure incremental change as the residuals management program and treatment plant upgrading are implemented. The priority areas to be studied include: (1) sources and fate of contaminants; (2) effects of contaminants and the health of the living resources; (3) nutrient enrichment; (4) economic, legal, political and social science assessment and; (5) public health impact. The study of these areas requires both short term projects designed to answer particular questions and a monitoring program that will determine long term impacts of human activities on the marine ecosystem. The technical results produced by these studies should be used in multiple-use management endeavors conducted by several agencies.

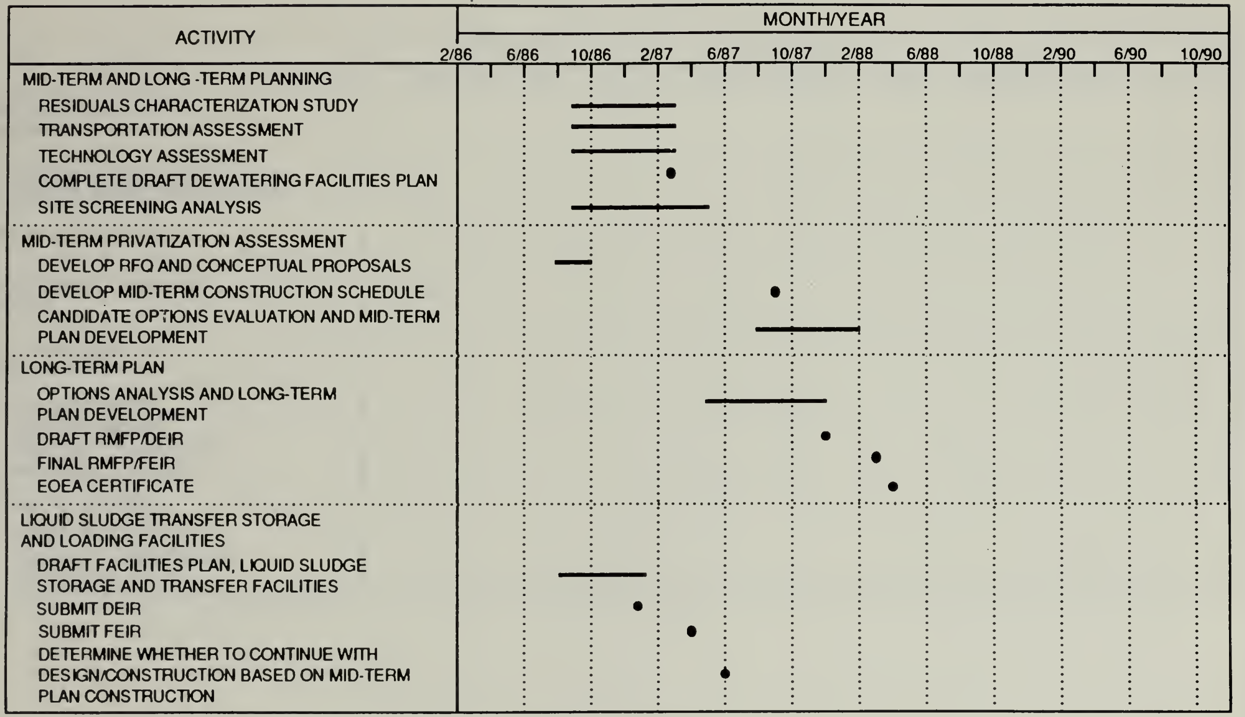

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FIGURE 3.3-1 RESIDUALS MANAGEMENT PROJECT SCHEDULE

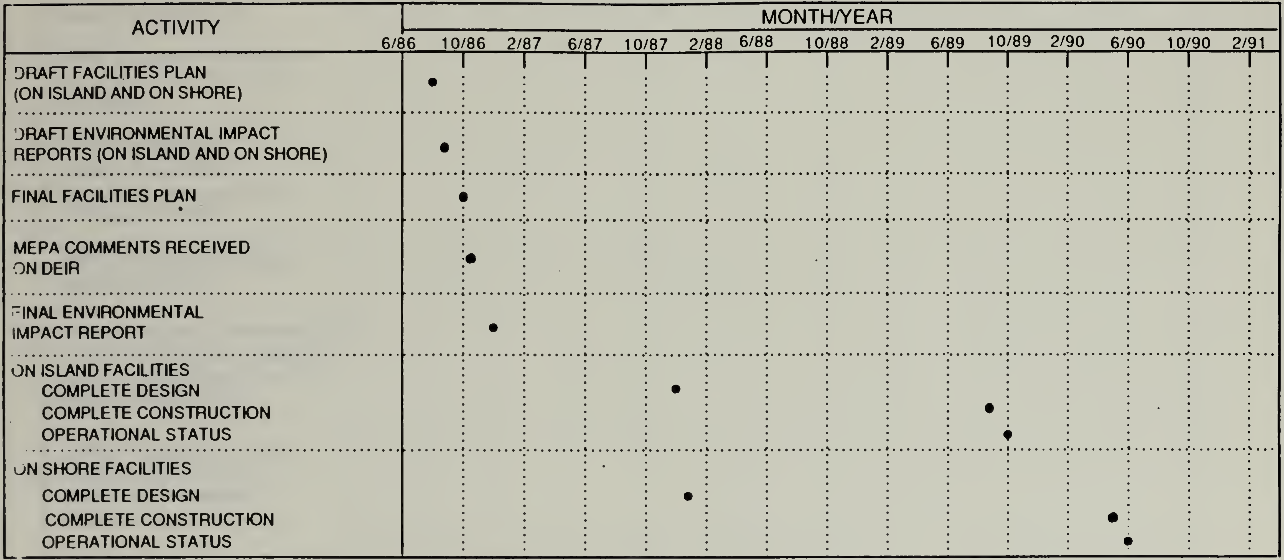

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FIGURE 3.3-2
WATER TRANSPORTATION FACILITIES
PROJECT SCHEDULE

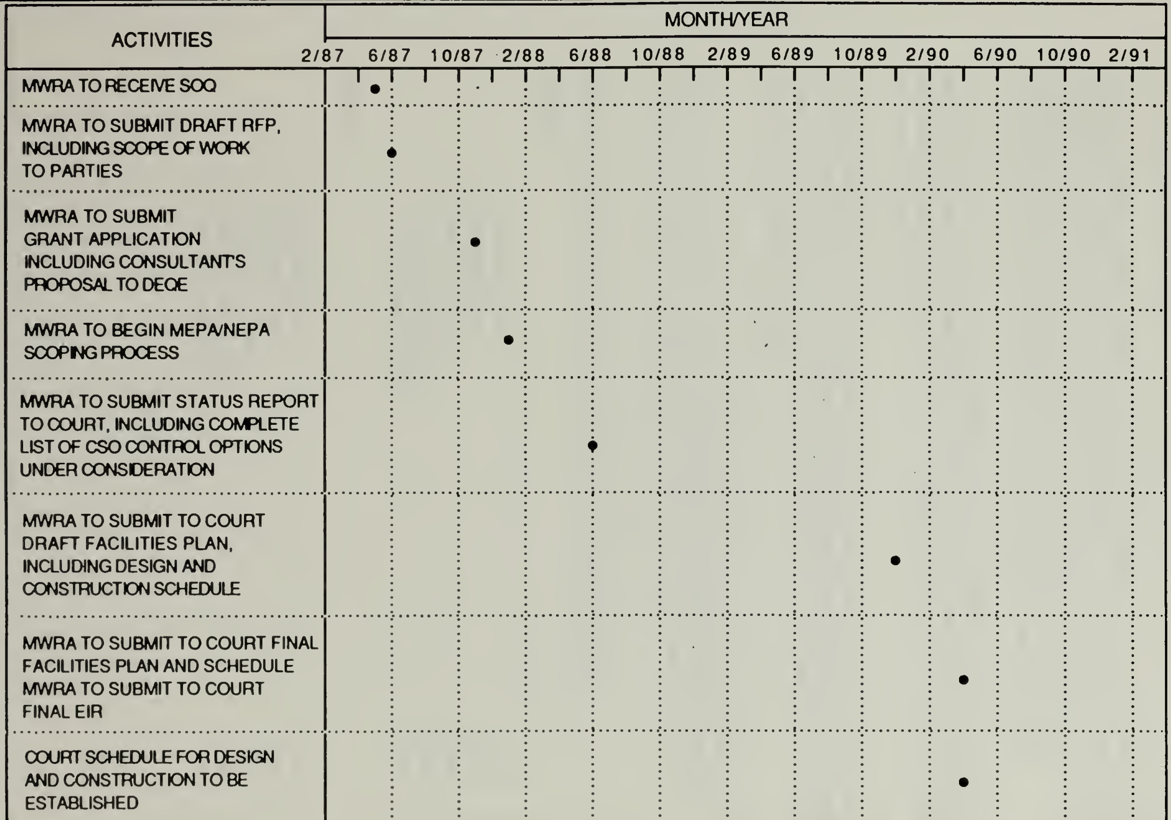

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FIGURE 3.3-3
COMBINED SEWER OVERFLOWS
PROJECT SCHEDULE

3.4 PROJECT MILESTONES

Though pollution of Boston Harbor has been a matter of public concern since the late 1960's, awareness was heightened in December of 1982 when the City of Quincy filed a lawsuit against the Metropolitan District Commission and the Boston Water and Sewer Commission (BWSC). Quincy sought relief from the pollution of Quincy Bay, which it claimed was resulting from the discharges of untreated and partially treated sewage from Nut Island and Moon Island.

As a result of this suit and the recommendations of the court-appointed special master, a bill was filed to remove sewer responsibilities from the MDC and to place them in a financially and organizationally independent public authority. On December 19, 1984, the Massachusetts Water Resources Authority was created.

On the following day, the EPA announced its intention to take additional action to help secure a harbor cleanup and brought suit in federal court, requesting a set of deadlines for pollution control projects. Filed at the end of January, 1985, the suit named four defendants: the MDC, the MWRA the state and the BWSC.

As a result of this lawsuit, on May 8, 1986 the United States District Court of Massachusetts imposed "major milestones" as long-term target dates to assist facilities planners toward the completion of primary and secondary treatment facilities. These dates are as follows, with milestone dates relating to this facilities plan in bold type:

Design and Construction of Piers and Staging Areas and Facilities Planning

On-Island

a. Complete Design	12/87
b. Bid Construction	5/88
c. Award Construction	8/88
d. Complete Construction	9/89
e. Attain Operational Status	6/90

On-Shore

a. Complete Design	1/88
b. Bid Construction	6/88
c. Award Construction	9/88
d. Complete Construction	5/90
e. Attain Operational Status	6/90

Facilities Planning

a.	**Project Start**	**5/86**
b.	**File ENF (s)**	**6/86**
c.	**Complete Draft Facilities Plan**	**9/87**
d.	**Complete Draft EIR**	**10/87**
e.	**Complete Final Facilities Plan**	**12/87**
f.	**Complete FEIR**	**2/88**
g.	**Complete Environmental Review**	**4/88**
h.	**Accept Facilities Plan**	**5/88**

Construction of Treatment Plant, Outfall and Inter-Island Wastewater Conveyance System

a.	Initiate construction of new primary treatment facilities	12/90
b.	Complete construction and commence operation of new primary treatment facilities	7/95
c.	Initiate construction of outfall	7/91
d.	Complete construction of outfall	7/94
e.	Initiate construction of inter-island wastewater conveyance	4/91
f.	Complete construction of inter-island wastewater conveyance	12/94
g.	Initiate construction of secondary treatment facilities	during 1995
h.	Complete construction of secondary treatment facilities	during 1999

The 1986 Court order allows for the reexamination of these long-term target dates for the completion of this Facilities Plan.

Section 3 References

G.L.C. 30 Section 61. Findings by the MWRA on the Selection of Deer Island as the Site for Wastewater Treatment Facilities in Boston Harbor.

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Section 4

SECTION 4.0 BASIC PLANNING CRITERIA

4.1 PLANNING PERIOD

The planning period used in the Secondary Treatment Facilities Plan encompasses the period from now through the year 2020. This represents the first twenty years of operation of the secondary plant which has been targeted by the federal court to be in operation not later than the end of 1999. The use of twenty year planning periods is considered generally accepted practice and is required by facilities planning regulations issued by the U.S. Environmental Protection Agency (EPA). The early site preparation-planning period encompasses the period from 1988 until 1990.

4.2 SERVICE AREA

Under its enabling legislation, the MWRA is charged with providing treatment to the wastewaters generated in 43 municipalities and special districts. The legislation permits permanent sewer service to other communities, but only after these communities have shown that no feasible alternatives exist, and after numerous regulatory and legislative approvals have been obtained.

Expansion of the service area, if it takes place, will occur at the boundaries of the existing service area. Figure 4.2-1 shows the existing service area, together with communities which are adjacent to the boundary of the area. Most communities abutting the Authority's service area are already served by a wastewater system. Any system expansion which might be considered would be on a very limited basis due to existing wastewater utilities on the perimeter of the MWRA service area. Therefore, in developing population and flow projections described in Volume II, Facilities Planning Background, the existing service area was used as a base.

Currently, the MWRA owns and operates two wastewater treatment plants, one at Deer Island and the other at Nut Island, which handle wastes from the northern and southern member municipalities, respectively. As indicated, some communities in the service area are serviced by both plants.

The Southern System encompasses an area of 236.83 square miles and presently has a total population of 745,917 and a contributing population of 629,553. Five MWRA pumping stations are located throughout the South System contributing area.

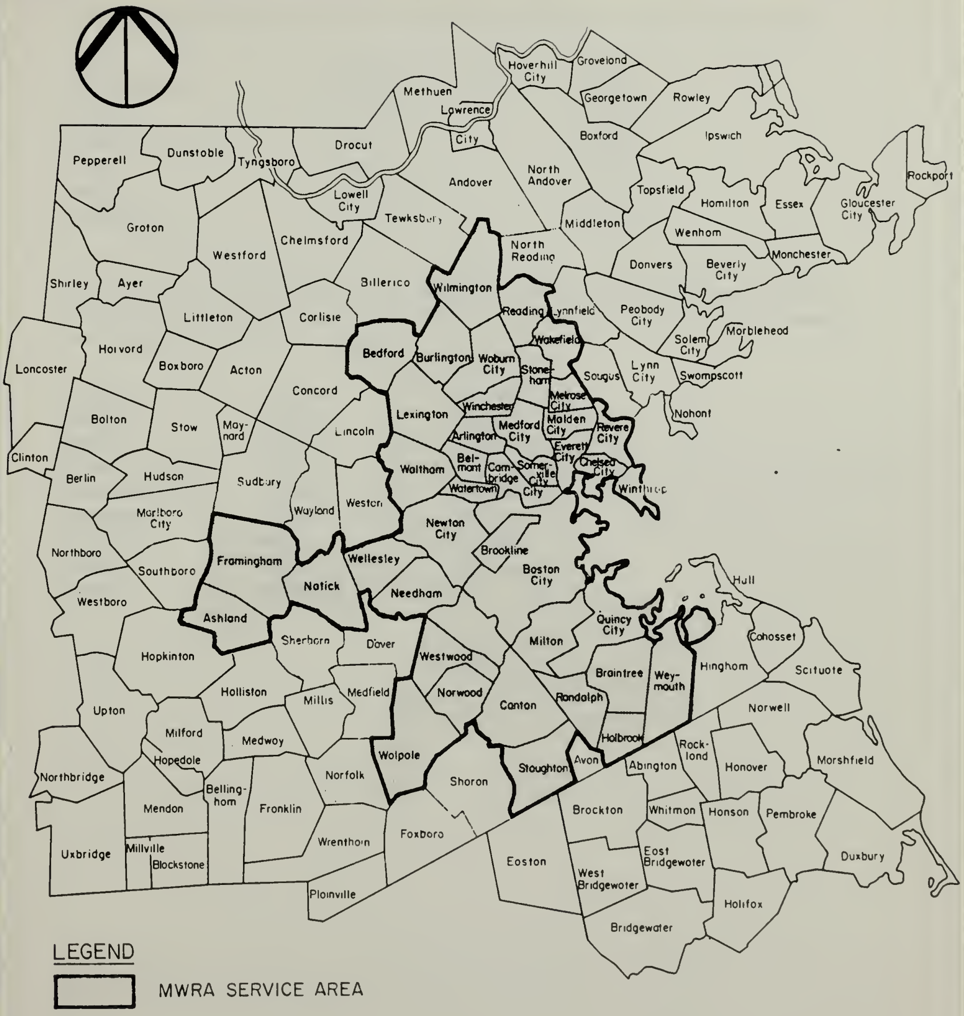

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FIGURE 4.2-1
MWRA SERVICE AREA

The Nut Island Facility (servicing the South System) presently serves twenty-one communities:

Ashland	Hingham.(N. Sewer Dist.)	Quincy
Boston (Part of)	Holbrook	Randolph
Braintree	Milton (Part of)	Stoughton
Brookline (Part of)	Natick	Walpole
Canton	Needham	Wellesley
Dedham	Newton (Part of)	Westwood
Framingham	Norwood	Weymouth

The Deer Island Facility serves twenty-six communities. The area served by this treatment plant is 168.03 square miles with a total population of 1,300,520 and a contributing population of 1,248,472. Six MWRA pumping stations are located throughout the North System contributing area. Member cities and towns include:

Arlington	Lexington	Stoneham
Bedford	Malden	Wakefield
Belmont	Medford	Waltham
Boston (Part of)	Melrose	Watertown
Brookline (Part of)	Milton (Part of)	Wilmington
Burlington	Newton (Part of)	Winchester
Cambridge	Reading	Winthrop
Chelsea	Revere	Woburn
Everett	Somerville	

4.3 DATUM PLANES

The base elevation to be utilized in the facilities plan is the MDC Sewer Datum. This is compatible with the datum previously used for the existing Deer Island and Nut Island treatment facilities.

Various datum planes are used in the Boston area, the most common of which are Mean Sea Level Datum (USGS datum of 1929), Boston City Base, and the MDC Sewer Datum. Table 4.3-1 has been prepared to present the relationship of the various datums to the MDC Sewer Datum.

TABLE 4.3-1

DATUM PLANES

To Convert From	To	Add
USGS Datum	MDC Sewer Datum	105.62 ft
Boston City Base	MDC Sewer Datum	99.97 ft

4.4 CRITERIA FOR EVALUATION OF EARLY SITE PREPARATION ALTERNATIVES

The purpose of this section is to describe the criteria that have been used to evaluate early site preparation alternatives. Early site preparation is defined as those construction activities required at Deer Island (e.g. partial removal of central drumlin, removal and disposal of grit and screenings, provision of a back-up service water system, demolition and removal of existing water reservoir and Fort Dawes facilities, protection of the existing outfall pipes) before construction of primary treatment facilities can begin.

Each alternative considered was compared with the evaluation criteria, as shown in Table 4.4-1. The evaluation in Section 7 presented sufficient information about each alternative in both summary and narrative form so that the MWRA Board of Directors was able to make an informed decision in selecting the recommended plan. Each of the criteria used is described in the following paragraphs.

Air Emissions Control

Air emissions control is defined as the potential for generating odor/air emissions and therefore, indirectly, as an indication of the level of control necessary to limit air emissions from early site preparation activities. Air emissions during early site preparation construction activities are discussed, but not evaluated by computer modeling because the anticipated emmissions are limited.

Noise Control

MWRA has committed to a program to comply with stringent noise mitigation and to develop a program to avoid adverse noise impacts during construction. For each project alternative, an estimate of the noise level expressed as dBA is presented. Resulting attenuated noise levels at various distances from the noise source are estimated. These estimates take into account mitigation measures such as earthen berms. Project component alternatives rated "difficult" have a potential for high noise levels and require a greater level of control. An alternative rated "modest" produces noise and requires noise control mitigation to about the same degree as typical site preparation projects. Alternatives may be rated "minimal" if no or little noise control is required.

Environmental Criteria

This criterion measures a project component's effect on selected environmental items during construction and, if applicable, during operation. The list below is based on EPA guidance for facilities planning. Each alternative was evaluated for impacts to:

- o Historical archaeological sites
- o Floodplains, wetlands and barrier beaches
- o Fish, shellfish and other marine biota
- o Wildlife and endangered species
- o Recreational opportunities

TABLE 4.4-1
SECONDARY TREATMENT FACILITIES PLAN
PROPOSED CRITERIA FOR DETAILED EVALUATION OF
OF EARLY SITE PREPARATION ALTERNATIVES

CRITERIA	INDICATORS
ENVIRONMENTAL	
Air Emission Control	See Text
Noise Control	Difficult, Modest, Minimal
Environmental Criteria	Significant, Modest, Minimal
Traffic	Number of Trips
TECHNICAL	
Area Requirements	Acres
Flexibility	Low, Medium, High
Constructibility	Aggravated, Modest, Minimal
Power Needs	Kilowatts
Quantity and Quality of Spoils	Cubic Yards
INSTITUTIONAL	
Timely Implementation	Difficult, Modest
Permitting	Extensive, Modest
External Coordination	Extensive, Modest, Minimal
Internal Coordination	Extensive, Modest, Minimal
Demand for Unique or Scarce Construction Resources	Difficult, Modest

TABLE 4.4-1 (cont.)
SECONDARY TREATMENT FACILITIES PLAN
PROPOSED CRITERIA FOR DETAILED EVALUATION OF
OF EARLY SITE PREPARATION ALTERNATIVES

CRITERIA	INDICATORS
INSTITUTIONAL (cont.)	
Flexibility to Meet Project Phasing	None, Fair, Good
COST	
Present Worth Costs	Millions of Dollars
Capital Costs	Millions of Dollars

Alternatives are rated as having "minimal", "modest", or "significant" effect.

Traffic

For each alternative, the number of construction personnel required during early site preparation is determined. Estimates of any materials requiring offsite transport and equipment required during construction are also determined. All needs are expressed as the number of daily trips (round trips) anticipated.

Area Requirements

For each early site preparation alternative, preliminary layouts and area requirements are discussed and described (acres).

Flexibility

Flexibility is defined as the degree to which early site preparation activities do not preclude the feasibility of possible options for engineering, construction and operation of existing and proposed treatment facilities. Alternatives ranked "high" offer the greatest flexibility, i.e., the fewest restraints. Alternatives ranked "medium" indicate reduced flexibility. Alternatives rated as "low" indicate significantly reduced ability to accommodate engineering options.

Constructibility

Constructibility takes into account many aspects of early site preparation including the degree of construction difficulty, duration, access requirements, sequencing, and scheduling. Construction work will be broken into appropriate packages depending on special labor skills required and phasing of the work. For this study, early site preparation alternatives are rated as presenting "minimal", "modest" or "aggravated" difficulty of construction.

Power Needs

Minimal power is required to support early site preparation alternatives. The quantity of power required for early site preparation is very small in comparison to the later construction activity requirements and the ultimate pumping and treatment power needs. Nevertheless, this criterion evaluates the need and amount of any offsite power required during early site preparation and the date by which it is required. Power needs are assessed by the extent to which demands exceed available supply. This criterion is thus expressed in kilowatts.

Quantity and Quality of Spoils for Disposal and/or Relocation

Early site preparation will require the movement of large quantities of soil and its subsequent disposal/use at either on-island or off-island locations. For this study, the total volume (cubic yards) of spoils requiring movement and the volume (cubic yards) requiring offsite disposal and/or reuse is presented for each alternative. In addition, material that will

require offsite disposal is assessed as to the type of material and the difficulty expected in ultimately disposing of this material.

Timely Implementation

Implementation is defined as the relative difficulty expected in maintaining the schedule for discrete, manageable components of early site preparation activities. For this study, two ratings are appropriate for this criteria: "modest" and "difficult". For alternatives with features likely to make implementation difficult or to cause project delays, the "difficult" rating is used. For other alternatives with fewer challenges, the "modest" rating is used.

Permitting

Permitting is defined as the measure of the relative difficulty in obtaining the necessary permits for an alternative. The alternatives will be rated "modest" or "extensive" reflecting the relative time required to obtain a permit.

External Coordination Requirements

External coordination requirements are a measure of the relative degree to which the Authority must interact with organizations outside the Authority to achieve the desired objectives. This includes consideration of legislative approval and other requirements necessitated by legal and jurisdictional limits to MWRA's authority. Alternatives are rated "minimal", "modest" or "extensive" depending on the degree of coordination required.

Internal Coordination Requirements

Internal coordination requirements are a measure of the relative degree of coordination required between Authority projects or programs such as the coordination required between the early site preparation activities and the existing treatment plant or other authority programs on Deer Island. Alternatives are rated "minimal", "modest" or "extensive" depending on the degree of coordination required.

Demand For Unique Or Scarce Construction Resources

This criterion is a measure of the demand that any one alternative may put on resources that are in scarce supply or not available in the local area. Key shortage of some labor skills and equipment may occur because of the concurrent construction of major projects such as the third harbor tunnel. Alternatives are rated "modest" if potential conflicts exist, or "difficult" if demands clearly exceed supply.

Flexibility to Meet Project Phasing

This criterion evaluates the site development alternatives according to the relative ease with which they could be modified to facilitate phasing of the primary or secondary plant with the goal of expediting the overall construction schedule. The degree of flexibility is assessed as "none", "fair" or "good".

Present Worth Costs

Present worth costs are the sum of those costs required to complete the early site preparation phase of the project. They are presented in the form of a single initial investment which according to EPA guidelines is equivalent to the costs of construction during the planning period. The design year of the project is 2020, twenty years after the planned startup of secondary treatment facilities and 25 years after the planned startup of new primary treatment facilities. The base month and year for all cost estimates is January, 1990, with all costs based on estimates of September, 1986, prices. The time frame for early site preparation work is 1988-1990. Therefore, present worth costs are assumed equal to capital costs for the early site preparation activities. Present worth costs for each alternative are presented in terms of millions of dollars.

Capital Costs

Capital costs of alternatives will include construction costs plus 35 percent to cover construction contingencies, administration, engineering and legal costs. Any significant and special mitigation costs will be included in the alternative costs. Construction costs of necessary facilities in this plan do not include costs for land purchase since these costs are common to all alternatives. Capital costs will be presented in terms of millions of dollars.

4.5 GUIDELINES FOR COST EVALUATION

The following guidelines for determining costs have been developed.

4.5.1 CONSTRUCTION COST INDEX

The construction costs used for the project are based on estimates of September, 1986 prices. The Construction Cost Index as presented in the Engineering News Record (ENR-CCI) for September, 1986, is 4332.5. An index of 4330 was used as the baseline cost index.

4.5.2 LAND COSTS

Exclusive of the land costs involved in the conveyance of wastewater from Nut Island and the City of Boston to Deer Island, the cost of land is not expected to become a part of the cost analysis. All land necessary for the work on Deer Island is already or will be owned by the MWRA and/or the Commonwealth of Massachusetts.

4.5.3 PROJECT COSTS

The term "project cost" is used throughout the discussion of cost factors. This cost consists of the estimated capital site preparation cost plus the cost of engineering and contingencies. The sum of engineering and contingency costs was estimated to be 35 percent of the site preparation cost; or, in other words, the estimated cost was multiplied by a factor of 1.35 to yield the project cost.

Section 5

5.0 BASIS OF ANALYSIS

5.1 DESCRIPTION OF SITE DEVELOPMENT NEEDS

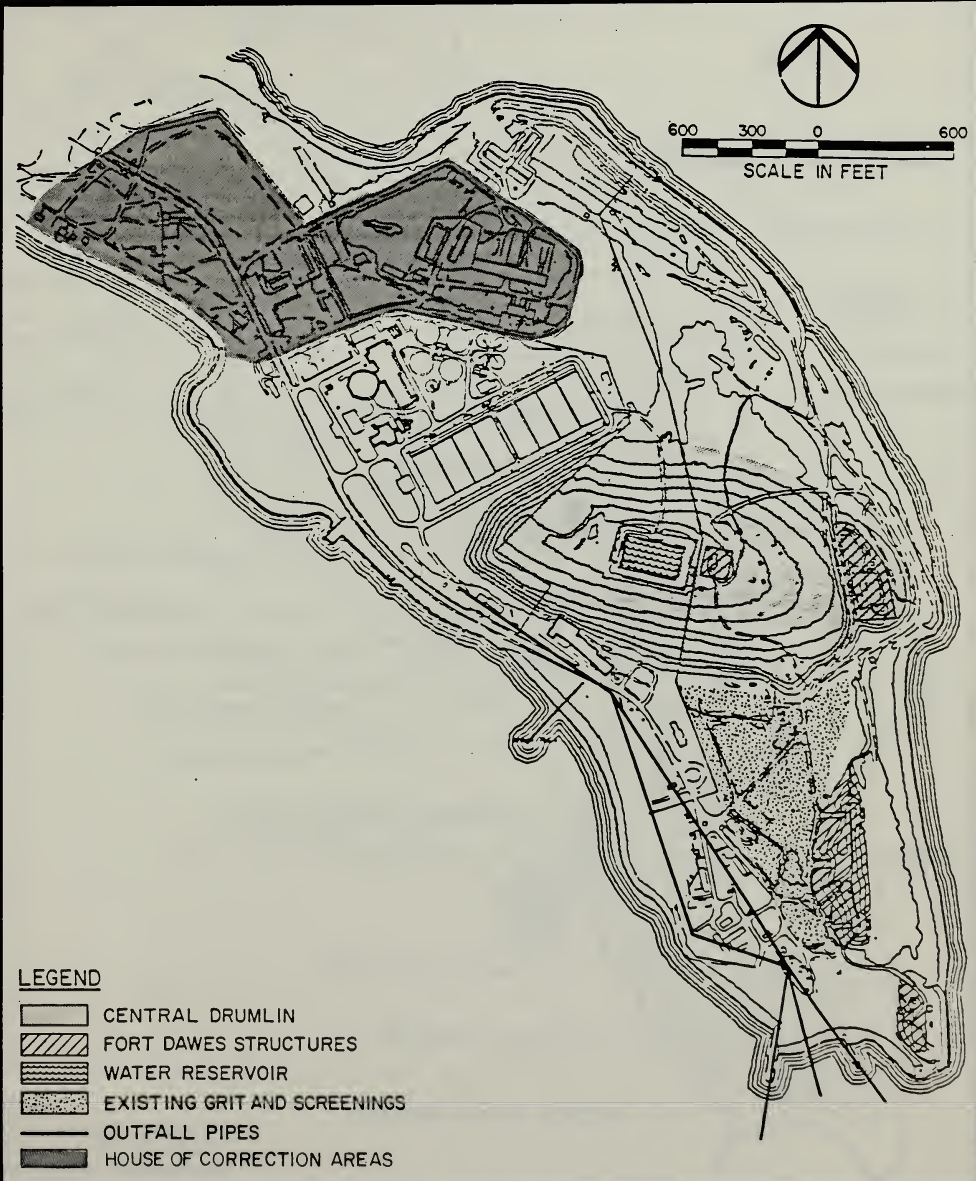
The purpose of this section is twofold: 1) to describe in broad terms the development needs of the total Deer Island site, beginning with early site preparation required for primary treatment construction, and proceeding through final site grading after construction of the secondary treatment facilities; and 2) to present in more detail the early site preparation development needs and impacts. Early site preparation is defined as any construction activity that can be initiated on Deer Island at an early date and particularly those activities that can be initiated prior to pier construction.

5.1.1 DESCRIPTION OF TOTAL SITE PREPARATION NEEDS

The limited size of Deer Island, maintenance of the existing treatment plant, overall court-imposed schedule milestones, environmental and institutional factors, the large volumes of materials that must be moved, the large size of the new primary and secondary treatment facilities, and the hydraulics of the treatment system combine to produce a complex total site development plan. Engineering evaluations of the treatment alternatives have not been completed at this time. Therefore, several assumptions have been made to define a representative facility to support total site preparation planning. The treatment facility "footprint" is based on a system with stacked primary clarifiers, activated sludge aeration tanks, stacked secondary clarifiers, and disinfection. The elevation of the primary clarifiers is assumed to be at 150 feet to allow a south to north gravity flow through the system with no effluent pumping. Although other treatment system alternatives are also being evaluated, site preparation plans are not expected to significantly change for the alternatives being considered.

Areas are also reserved on Deer Island for residuals and pier facilities. The areas which remain around the perimeter are assumed to be available for landform and joint use development, with the exception of a possible historic period cemetery located northeast of the Hill Prison building. Landforms are developed based on a 2 to 1 horizontal-to-vertical side slope and a top elevation approximately equivalent to the maximum elevation (approximately 200 feet) of the existing drumlin. Figure 5.1.1-1 shows the existing site topography and facilities. Figure 5.1.1-2 illustrates the general concepts for the new treatment facility site layout and landforms.

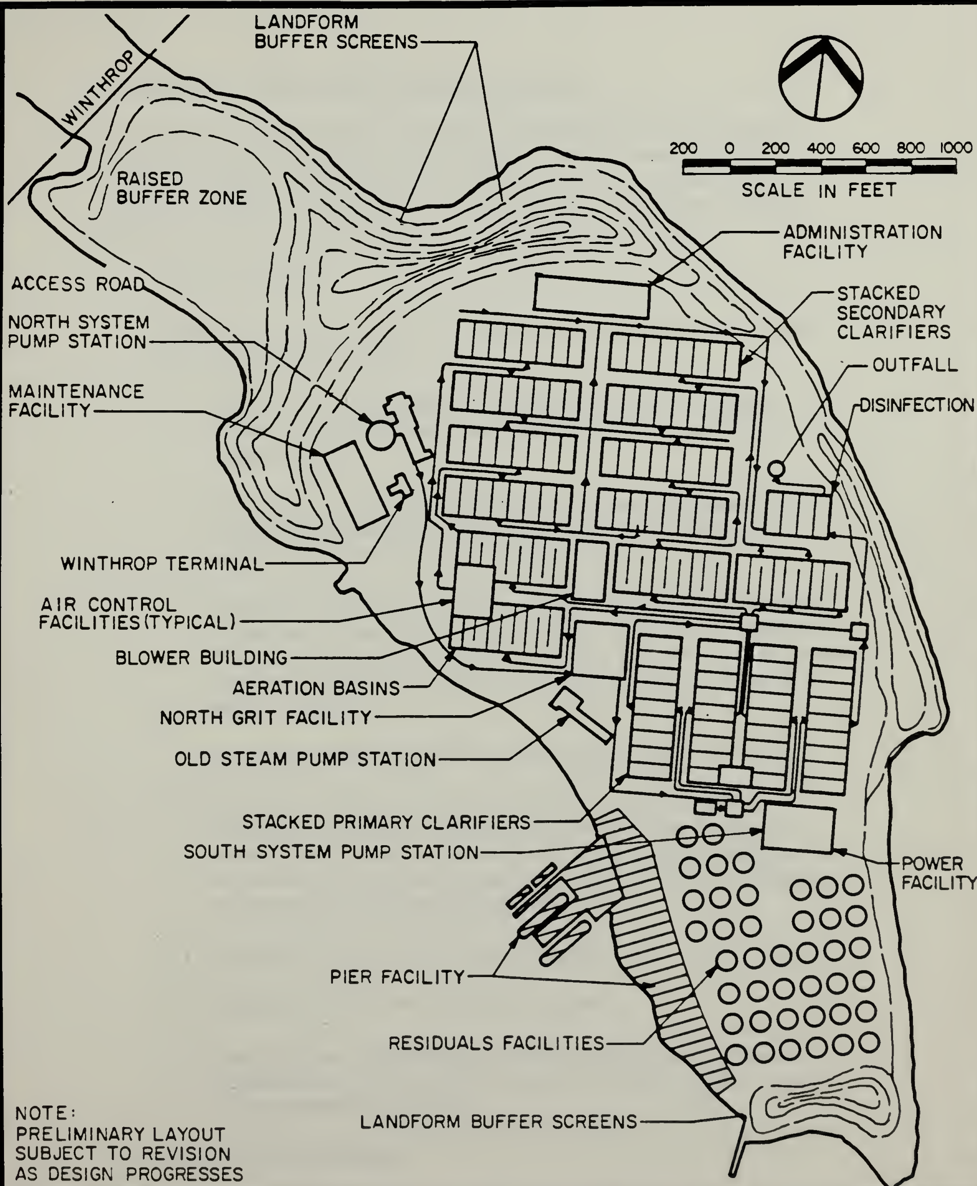
The overall schedule milestones for the project are largely established by the court-imposed cleanup schedule for Boston Harbor. To achieve this schedule, a three-phase development of the island is proposed. This phased approach is consistent with maintaining the operation of the existing treatment plant while new primary treatment facilities are constructed on the southern half of the island, followed by the construction of the secondary treatment facilities in the area of the existing treatment and correctional facilities. The three phases of site preparation are as follows:



MASSACHUSETTS WATER RESOURCES AUTHORITY

FIGURE 5.1.1-1
EXISTING DEER ISLAND LAYOUT

1



MASSACHUSETTS WATER RESOURCES AUTHORITY	FIGURE 5.1.1-2 SITE LAYOUT SECONDARY TREATMENT FACILITIES DEER ISLAND

Site Preparation I - January 1988 through December 1991.

Site Preparation I work will actually consist of two distinct efforts needed to prepare the island for the construction of new primary facilities: 1) Early site preparation to be initiated prior to the construction of on-site piers (depends upon the availability of the prison area for landform construction), 1988 to late 1990; and 2) Completion of drumlin excavation to provide level platforms for the new facilities, 1990 through 1991.

A. Early Site Preparation

The following work is scheduled to be initiated prior to the completion of on-island pier facilities - 1988 to late 1990.

- o Protection of existing outfall pipes against heavy construction equipment traveling in this area and/or excessive standing loads (e.g. landforms or material storage).

- o Grit and screenings removal, stabilization (as required), and disposal work. This activity is scheduled to be done, to the extent feasible, during the cooler months of 1988 and 1989 to reduce potential odor impacts.

- o Provision of a non-potable back-up service water system. A new closed-loop service water cooling system is being provided through the Deer Island Fast Track Improvement Program. A back up service water system will be completed during early site preparation which will serve both cooling and disinfection needs, as required.

- o Demolition of existing non-potable water reservoir on top of the drumlin.

- o Implementation of first phase drumlin removal to support the start of construction of the primary treatment and residual facilities no later than January 1991. A goal is to construct, early in the schedule, a large berm at the northern end of the island to provide a noise and visual buffer between Winthrop and Deer Island construction activities.

- o Preparation of site for a concrete batching plant.

- o Relocation of island access facilities, as required.

- o Commencement of demolition and removal of the existing prison facilities; demolition of Ft. Dawes with the areas filled in and graded to meet treatment facilities construction elevations.

B. Completion of Site Preparation I

The following work is planned after completion of the on-site pier facilities to provide a level platform for the new treatment facilities - late 1990 through 1991.

- o Second phase drumlin excavation, completing removal of the central drumlin. The excavated materials will be used to construct additional berms during 1991. Temporary earth stockpiles will be constructed in non-berm areas. Should the prison facilities not be decommissioned by 1989 and excavated materials not be allowed off-island, these excavated soils will require relocation two or three times prior to final placement.

- o Construction of concrete batching facilities to permit start of construction of primary treatment and residual facilities.

- o Construction of the pump station shafts for the inter-island and outfall tunnels.

- o Completion of the demolition and removal of the existing prison facilities with the areas filled in and graded to meet secondary treatment facilities construction elevations.

Site Preparation II - January 1992 through December 1994

Site preparation II work will progress uninterrupted during this period to allow construction of the secondary facilities to commence in 1995. Modification, maintenance and operation of the existing primary treatment facilities will be ongoing until the new primary treatment facilities are operating.

The site preparation work will include:

- o Continued movement and placement of excavated materials, site grading and construction of berms in the north and east areas.

- o Handling of the outfall and inter-island tunnel spoils on-island and off-island, which will progress to completion before the new primary treatment facilities are operating.

Site Preparation III - January 1995 through December 1999

Site Preparation III will concentrate on existing facility demolition, and the completion of site landforms, site drainage, permanent roads, finish grades and landscaping. The secondary treatment facilities will be completed and put into operation during this final phase.

Throughout all of the phases of the work described above, there are several environmental and institutional considerations that must be addressed and goals that must be met. MWRA has committed to using numerous measures to mitigate impacts, with particular attention to alternative transportation means, noise control, and odor control.

Transportation has a major influence on site preparation. MWRA has committed to the barging of almost all heavy construction equipment and material as well as to the busing and/or ferrying of workers.

Noise from construction activities must be controlled to the maximum extent feasible. As a minimum, noise levels must meet regulatory requirements. Perimeter area landforms will be constructed to provide both open space and noise/visual buffer zones between the plant and surrounding areas. Early construction of a landform is proposed at the northern end of the island between Winthrop and the plant to implement this measure.

In addition, odors must be controlled to eliminate detectable odors offsite and to protect public health. Onsite odors generated as a result of new plant construction will be minimized to the extent feasible. Other environmental factors that are important to site preparation are dust control, erosion and sediment control, shoreline protection, and the maximum onsite use of excavated materials.

The primary institutional factor constraining site preparation is the presence of the Deer Island House of Correction. Early decommissioning of the prison operation in accordance with applicable state law will greatly facilitate total site preparation and early site preparation in particular.

Another institutional constraint relative to timely project completion is the possible presence of a historic period cemetery. Archaeological studies are underway to assess the historical value of the cemetery and, if necessary, ways to preserve it. For early site preparation, it is assumed that this area is unavailable. In addition, it is assumed that all historical structures will remain during the early site preparation period. Volume III, Treatment Plant, will address the results of the archaeological studies and the later treatment of historic structures on Deer Island.

5.1.2 EARLY SITE PREPARATION NEEDS

Early site preparation is that work required to support the start of construction of the new primary treatment facilities by December, 1990, and that can be completed in advance of the water transportation facilities. The following early site preparation activities require initiation at an early date.

- o Support and protection of the existing outfall pipes.

  The outfall pipes extending from the existing plant and discharging off the southern tip of Deer Island have approximately 6 ft of earth cover. The residuals area and the on-island piers loading area will extend over these existing outfalls. These areas will be dominated by heavy construction equipment movement and/or material storage that will create increased stresses in the outfall pipes. The area proposed for grit and screenings disposal and landform development on the southern tip of the island is also located over the outfall pipes. The pipes may require protection against these newly imposed loads in order to avoid damage during the construction period. Therefore, the pipes must be inspected and any required support and protection of the pipes must be designed and in place prior to the start of any

construction work to guard against pipeline failures in these areas. An important consideration related to this activity is that access to manholes/chambers must be maintained at all times. The design of the marine docking facilities include protection for the outfall pipes located within 70 ft of the proposed bulkhead structure.

o Removal of existing grit and screenings.

The removal of the grit and screenings from the present areas for final disposal on Deer Island must be completed before major drumlin excavation can begin. The final disposal area for grit and screenings will be located at the southern tip of the island in an area designated for landform development. In an effort to expedite portions of the construction, this activity will be initiated prior to the availability of the on-island piers. As such, the goal is to dispose of this material onsite in compliance with applicable regulatory requirements. As a mitigation measure, grit and screenings excavation will be performed, to the extent feasible, in the cooler months of 1988 and 1989 to minimize odor potential.

There are two alternatives for onsite disposal of the grit and screenings. One alternative is a secure landfill for the material as it exists, and the other alternative is chemical stabilization of the material prior to final disposal by burial in a landform. A leachate collection system must be constructed for the landfill alternative with the collected leachate conveyed via pipeline to the existing wastewater treatment plant. These alternative approaches are described and evaluated in Section 7.

o Elimination of the dependency of the plant service water system on the water reservoir.

The existing non-potable water reservoir, located atop the large drumlin at elevation 207 ft, supplies cooling water to the diesel generators located in the electrical building adjoining the main pump station and serves as a primary or secondary water supply for other uses. These generators can operate 24 hours per day in response to power demand. The removal of the drumlin for new primary plant construction will require early demolition and removal of this reservoir. A closed-loop service water system is being designed and installed at the existing plant under the Deer Island Treatment Plant Fast Track Improvement Program that will eliminate dependency on the water reservoir as a primary source of cooling water. A back-up service water system must be designed and installed prior to the demolition of the existing reservoir.

The MWRA has decided to convert the existing chlorine gas effluent disinfection system to a sodium hypochlorite-based system. For the new hypochlorite system, the

non-potable make-up water requirements currently satisfied by the reservoir will be greatly reduced. In addition, the Deer Island Fast Track Improvement Program has included cooling system modifications that will reduce the non-potable water demands to a back-up for the new service water system. However, for early site preparation scheduling and cost studies, it has been assumed that neither of these modifications will be on-line to meet the water reservoir demolition schedule. Therefore, costs for the back-up system reflect the anticipated, higher level of demand on the system's service.

- o Partial excavation of the central drumlin and creation of a southern landform and a landform at the northern end of the island between Winthrop and the plant.

  Sufficient portions of the large central drumlin will be excavated to elevation 125 ft to permit the start of construction of the primary treatment, some portion of the secondary treatment, and the residual facilities. A large berm and supplemental noise barrier berm at the northern end of the island will be constructed from these excavated soils to provide a buffer between Winthrop and Deer Island activities. The existing access facilities to the island will be relocated as necessary to accommodate building of these northern landforms.

  The location of the landforms during the early site preparation phase of the work will depend largely on the removal date of the prison operation from Deer Island. Applicable state law requires that the House of Correction be relocated by 1989, a time frame that is consistent with the needs of early site preparation. Any delay in relocation will conflict with early site preparation and may require the phased construction of the northern landforms. In addition, a delay in relocation may require that special measures be taken to mitigate the impacts of construction on the occupants of the House of Correction. A discussion of the impacts of two alternate dates for prison decommissioning is contained in Section 7.

- o During the early site preparation time period it will also be necessary to finalize the utility (electrical power, water, and telecommunications) and concrete batch plant requirements identified in the facilities plan as necessary to support construction of the treatment plant and inter-island and outfall conduits. Allowance may have to be made for handling materials excavated from the inter-island and/or outfall shafts as well as the demolition of the prison and Fort Dawes. The extent of the impact of shaft construction during early site preparation will depend on the schedule developed for the completion of the conduit system.

5.2 SCHEDULING CONSIDERATIONS

The overall major milestone target schedule for the project, as established by the U.S. District Court of Massachusetts, is presented in Section 3.4. The total site preparation schedule is constrained by the following project requirements, which affect project constructibility, duration and costs:

- o Maintenance of the existing primary treatment plant during site preparation and during construction of the new primary treatment facilities.

- o Land/space restrictions at the site (e.g. the prison facility property, pier construction area, interim residuals handling, etc.) which restrain the movement of earth on-site and to on-shore locations.

- o Mitigation commitments - Time and location restrictions placed on construction-related transportation of materials, supplies and personnel through local communities to and from off-site locations; time and location restrictions placed on over-water transportation for construction personnel, equipment and materials from on-shore locations to the on-island piers; and noise control requirements.

The general sequence of the site preparation work also impacts the scheduling of construction. The most critical site preparation activities will be drumlin excavation and activities associated with the movement of excavated materials on-island and off-island.

Total site preparation will be scheduled to take place during the three (3) previously discussed phases in order to support the project court target dates and to prepare a level platform for plant construction.

5.3 TRANSPORTATION CONSIDERATIONS

The basis for transportation planning for Deer Island is set largely by the MWRA commitment to specific mitigation measures agreed upon during the facility siting effort. Due to the volume of anticipated traffic during certain phases of the project and the location of roadways leading to the plant site, MWRA determined that busing and water transportation will be employed as appropriate to minimize impacts on local communities. However, for the early site preparation phase, transportation of all workers and most construction materials will be via roadway.

5.4 MAINTENANCE OF EXISTING TREATMENT FACILITIES

This section highlights the possible effects that the continued operation of the existing primary treatment facilities will have on early site preparation activities. The major early site preparation activities which are affected by the existing primary treatment facilities operation are:

- o Demolition and removal of the plant water reservoir which supplies cooling water to the diesel engine generators and chlorine effluent make-up.

- o Transportation of materials and equipment on-island and off-island.

A new plant service water closed-loop cooling system for the engine generators is being installed in the Deer Island Fast Track Improvements Program. This system must be operational prior to the demolition and removal of the plant water reservoir located atop the central drumlin. An alternate service water supply must be designed and available as a back-up to the closed-loop system and to supply other existing demands.

Early site preparation equipment and material movement on-island and off-island must be coordinated with the chemical deliveries to the existing primary treatment facilities in a manner that will not create delays to the operations of these facilities or delays to the progress of early site preparation. In addition, all early site preparation activities must be coordinated with the construction of interim residuals management facilities, fast track improvements, and on-island piers. As part of the interim residuals management on Deer Island, MWRA is planning to perform a one-year demonstration program, beginning early in 1988, which will test the chemical fixation of scum. This full-scale testing program, which has the potential to be extended beyond the one-year period, will evaluate the chemical process and product characteristics of stabilized scum, which will be processed at an average rate of approximately 13 yd^3/day. Stabilized scum will be temporarily stockpiled on the southern portion of Deer Island, and either will be removed off-island by marine transport, or will be incorporated in structural fill used on Deer Island. Planning for the location of the temporary stockpile of stabilized scum will be performed following selection of a contractor for the scum stabilization program.

5.5 QUANTITY DEVELOPMENT

Total site preparation at Deer Island involves the three-phase movement and use or removal of large volumes of earth, grit and screenings, landfill wastes, demolition debris, and tunnel spoils, to prepare the site for construction The quantities and characteristics of the materials being moved only in the early site preparation phase are described in this section. Electric power and potable water utilities required to support project construction beyond early site preparation are also discussed in this section.

5.5.1 EXCAVATED MATERIALS

To prepare Deer Island for construction of the new treatment facilities, onsite soils will be excavated down to the grade elevations required to construct the basins and to establish the hydraulic gradient across the facilities. The water surface elevation for the proposed primary sedimentation is currently estimated to be 150 ft.

Approximately 1.6 million yd^3 of material, exclusive of grit and screenings, will be excavated during the early site preparation period, the majority coming from the southern section of the large drumlin in the center of Deer Island. Drumlin material consists mostly of glacial till with varying thicknesses of very dense sand, gravel, silt, clay, cobbles and boulders. Based on available data, this material is expected to be suitable as fill for the construction of onsite landforms. A portion of the material will also be suitable as structural fill in areas where treatment facilities will be developed later.

5.5.2 GRIT AND SCREENING LANDFILL WASTES

Grit and screenings from the North System headworks have been disposed of on Deer Island since the mid-1960's. The volume of grit and screenings landfill in place on Deer Island was determined in late 1985, as part of a report on an interim closure plan for the disposal areas (CDM, 1986). A series of test pits were dug throughout the several locations in the southern portion of the island known to contain grit and screenings. This field program identified the lateral and vertical extent of the grit and screenings materials. Based on this information, the volume of grit and screenings was calculated to be approximately 70,000 yd^3. However, additional material was placed after the date of the field test program (December 1985) and it is likely that some additional material extends beyond the limits drawn. Therefore, the total grit and screenings volume has been estimated to be 85,000 yd^3. Interim closure of the existing grit and screenings disposal areas has been planned for 1988 and will consist of providing drainage improvements, grading, temporary cover, and seeding. Interim closure may not be required if the final excavation and closure under this facilities plan can be advanced as proposed.

No historical data exists regarding the chemical and physical characteristics of the contents of the grit and screenings disposal areas. Extraction Procedure (EP) toxicity analyses performed on fresh grit and screenings from the North System headworks in 1981 indicate that these materials are not hazardous (Stone & Webster Engineering, 1985).

As part of the early site preparation activities for the secondary treatment project, the grit and screenings in the onsite disposal areas must be removed to allow for preparation of the area for the primary treatment and residuals management facilities construction. Disposal alternatives for the grit and screenings are developed more fully in subsequent sections of this document and disposal of both untreated and chemically stabilized material in an onsite landfill is discussed. To support this evaluation, laboratory testing of raw and stabilized grit and screenings samples from the disposal areas was performed. Physical and chemical testing was performed by Chemfix Technology, Inc. (Chemfix, 1986). Refer to Appendix A for a copy of the Chemfix report.

The volume of material to be disposed of will be influenced mainly by the actual extent of grit and screenings disposal areas as determined during the excavation phase, the extent to which soil is excavated along with the grit and screenings, and the extent to which chemical stabilization is utilized. The first two factors cannot be estimated at this time. If chemical stabilization is utilized, the expected volume increase is less than 3 percent. Assuming a 3 percent increase in the above identified volume of 85,000 yd^3, approximately 87,500 yd^3 of stabilized grit and screenings would require disposal.

Grit and screenings from the disposal areas will be excavated during the cooler months of 1988 and 1989, to minimize potential odor problems. If stabilization is employed, this activity may continue into the winter of 1990 depending on the processing rate.

5.5.3 DEMOLITION DEBRIS

Demolition debris will be produced from the demolition and excavation of existing structures. This material can be classified as:

- Brick and block
- Granite and concrete
- Combustible materials, e.g. lumber
- Miscellaneous metals and structural steel
- Dismantled equipment and pipes

It is anticipated that approximately 50,000 yd^3 of material will be produced during the early site preparation period from the demolition of the existing structures. Most of the demolition debris will be produced by the demolition of structures associated with the existing concrete wall traversing the island, the Fort Dawes facilities including bunkers, and the existing reservoir.

Later site development will include plans to use classified demolition materials such as brick and block for fill, and granite and concrete for landform development and shore and/or embankment protection at Deer Island and Nut Island.

5.5.4 UTILITY REQUIREMENTS

Early site preparation and construction will require very little in terms of additional electrical power or potable water. However, the subsequent construction phases of the project will place significant demands on these utilities.

A shortage of electric power will exist for an interim period prior to the installation of the long-term power supply on Deer Island. There is currently no offsite electric power supply to the Deer Island treatment plant. Power is supplied via diesel generators or diesel pump drives. Under the Deer Island Fast Track Improvements Program, two diesel generators are being installed to support the partial electrification of the influent pump station. The available onsite capacity and projected peak demands over the interim period are presented in Table 5.5.4-1. Increases in the demand during the 1988-1990 period will result from the pier construction, temporary shelters, lighting, and miscellaneous construction uses. Based on these estimates, demand will exceed the supply when the Tunnel Boring Machines (TBM's) begin operating in 1991. Methods of meeting this demand are being evaluated and will be reported in Volume III, Treatment Plant.

Similarly, the water supply to Deer Island is limited. Water is currently supplied to the Deer Island treatment plant and the House of Correction through several interconnected water mains. Testing of the water lines in December 1986 indicated that this supply is capable of providing 640,000 gallons per day at a residual pressure of 20 psi. Average and maximum water demands for Deer Island facilities are currently about 100,000 and 200,000 gallons per day, respectively,

TABLE 5.5.4-1
PRELIMINARY POWER NEEDS OF SECONDARY TREATMENT FACILITIES PLAN

Year	Description of power needs	Average load (kW) period	Cumulative average load (kW)	Peak load (kW) period	Cumulative peak load (kW)	Cumulative Installed capacity (kW)	Cumulative Secure capacity (kW)	Cumulative Shortfall (kW)
1986	One electrified influent pump	1,500		1,500		3,500	2,800	
1986	Basic power usage	650		650				
			2,150		2,150	3,500	2,800	0
1988	Electrification of four influent pumps (additional) and Winthrop terminal pumps	2,500	4,650	7,200	9,350	12,000 15,500	6,000 8,800	550
1990	Construction power	10,000	14,650	15,000	24,350	0 15,500	0 8,800	15,550
1991	Primary sludge-dewatering, piers and basic power	3,000	17,650	3,000	27,350	0 15,500	0 8,800	18,550
1993	Basic power usage	2,000		3,000		0	0	
			19,650		30,350	15,500	8,800	21,550
1995	Primary treatment and basic power usage	6,800		7,900				
	Electrification of five influent pumps, Winthrop terminal pumps and South System flows	4,100		17,700		12,000	6,000	

TABLE 5.5.4-1
(Continued)

Year	Description of power needs	Average load (kW) period	Cumulative average load (kW)	Peak load (kW) period	Cumulative peak load (kW)	Cumulative Installed capacity (kW)	Cumulative Secure capacity (kW)	Cumulative Shortfall (kW)
	Air emissions control	1,250		1,250				
	Disinfection (NaOCl purchased)	0		0		0	0	
	Construction power	-7,000		-12,000				
			24,800		45,200	12,000	6,000	39,200
1999	Secondary facilities and basic power usage	12,500		19,400				
	Additional air emissions control	1,250		1,250				
	Sludge processing	2,000		2,000				
	Disinfection (NaOC1 purchased)	2,300		.0		0	0	
	Construction power	-3,000		-3,000				
			39,850		64,850	12,000	6,000	58,850

plus allowances for a fire flow. Various additional water demands will be realized over the construction and operation phases of the primary and secondary treatment facilities. The earliest significant demand will be associated with the concrete batching plant to be located on the island subsequent to the early site preparation phase. Estimated average and peak water demands are 20,000 to 60,000 gallons per day beginning in early 1991. Ultimately, the water demand during the operation of primary and secondary treatment facilities will approach 2 million gallons per day. Thus, a new and/or modified water supply will ultimately be required. The approach and schedule for providing the new supply will be presented in Volume III, Treatment Plant.

Section 5.5 References

Camp, Dresser and McKee, October, 1986. Field Investigation and Interim Closure Design Plan and Report for Grit and Screenings Disposal Areas on Deer Island.

Stone and Webster Engineering Corporation, August, 1985. Interim Sludge Disposal Study.

Chemfix Technologies, Inc, July, 1987. Feasibility Study and Engineering Evaluation of Grit and Screenings by Chemfix Process.

Section 6

6.0 EXISTING CONDITIONS

6.1 EXISTING FACILITIES

6.1.1 DEER ISLAND TREATMENT PLANT

The Deer Island Wastewater Treatment Plant, originally completed in 1968, provides primary treatment to flows from the North Metropolitan Sewerage System. The plant was designed to treat an average flow of 343 mgd and a peak flow of 848 mgd. Treatment consists of preaeration, primary sedimentation, and disinfection.

Flows from the Boston Main Drainage and North Metropolitan Relief Tunnels are pumped to the treatment plant at the Deer Island Main Pumping Station. Flows from the North Metropolitan Trunk Sewer are discharged to the plant via the Winthrop Terminal. Mixed flows are discharged to two preaeration channels. Primary treatment is provided by eight sedimentation tanks. Effluent from the primary tanks is chlorinated and discharged to the harbor through a series of outfalls.

Primary sludge, grease, and scum is collected, thickened, and pumped to anaerobic digesters. Digested sludge, and bypass flows from the Winthrop Terminal, are mixed with the primary effluent prior to discharge to the harbor.

Major Components

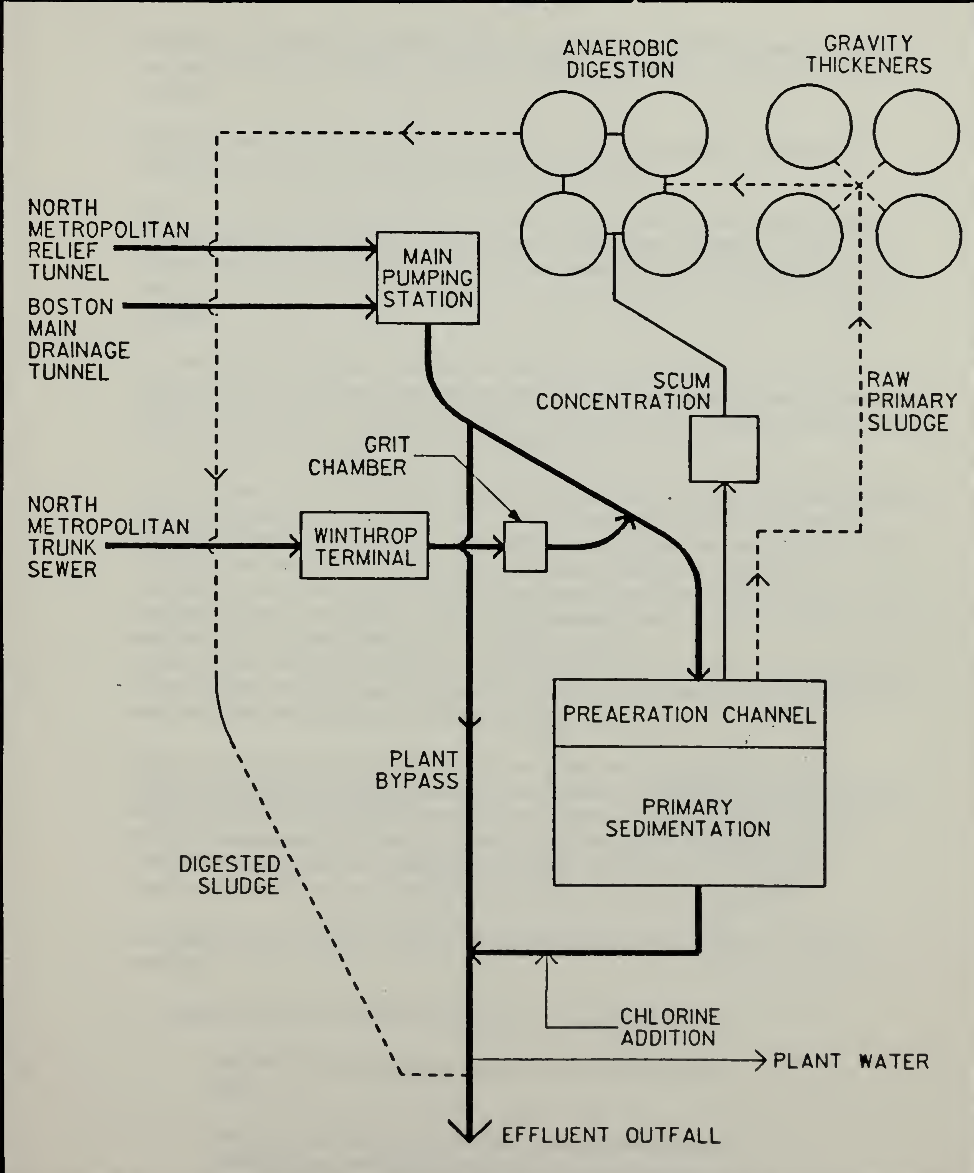
The major components of the original Deer Island Wastewater Treatment Plant include the following:

- Nine main sewage pumps, 90 mgd each
- Two preaeration channels, 400 ft x 20 ft
- Eight primary sedimentation tanks, 245 ft x 100 ft
- Four raw sludge pumping stations with three pumps in each
- Four anaerobic digester tanks
- Five diesel generating sets, 700kw each
- Seven chlorinators, 8,000 lb/day each
- Five outfalls to the harbor

Schematics of the Deer Island Wastewater Treatment plant showing the flow pattern, the number and arrangement of treatment units, and the outfall system are shown in Figure 6.1.1-1.

Main Pumping Station

The Deer Island Treatment Plant Main Pumping Station consists of nine vertical shaft, mixed flow, bottom suction sewage pumps. Each pump is rated for 90 mgd at 105 ft tdh and 400 rpm. The pumps were designed to be operated over a speed range of 250 to 400 rpm. An empty bay is provided in the pumphouse for a tenth pump.



MASSACHUSETTS WATER RESOURCES AUTHORITY	FIGURE 6.1.1-1 DEER ISLAND WASTEWATER TREATMENT PLANT SCHEMATIC

The pumps are driven through 90 ft long shafts. Eight pumps are driven by diesel engines, and one pump is driven by a 2,000 hp synchronous electric motor with a variable speed magnetic coupling.

The diesels are 12 cylinder, radial type, vertical shaft engines furnished by the Nordberg Manufacturing Company of Milwaukee, WI and St. Louis, MO.

Each pump suction piping connects to a bifurcation which is piped to both the Boston Main Drainage and North Metropolitan Relief Tunnels. Each leg of the bifurcation contains a 60 in diameter butterfly valve and a 60 in diameter rubber expansion joint. The butterfly valves are pneumatically operated with a manual handwheel override. There are no valves on the pump discharge.

The pumps lift the wastewater to the treatment plant by a 60 in diameter pipe. Each pump discharge has a venturi meter to measure pump flow. Each pump discharge line is arranged as a siphon and each siphon is equipped with vacuum priming and vacuum breaking piping and valves. Two vacuum pumps are provided to prime the nine siphons.

The Deer Island Main Pumping Station receives wastewater from the three remote headworks and lifts it to the head end of the treatment plant. The pumping rate is adjusted to maintain a constant water level at the headworks. Pump start up and shutdown, and butterfly valve opening and closing, are done locally. Adjustment of pump speed is done either manually or automatically in the control room. Pump suction valving is such that any pump may take suction from either tunnel. The original nickel-iron alloy impellers have been replaced. Seven impellers are now stainless steel and two are nickel-iron alloy.
The pump drivers are arranged in two rows (odd numbers to the west, even numbers to the east) at floor elevation 130 ft, the operating floor of the Main Pumping Station. The original plant design includes space allocation for a future pump (No. 10).

Based on discussions with plant operators and a review of the Deer Island Facilities Plan - Volume 1 Fast Track Improvement document, the unreliability and high maintenance associated with the Nordberg diesels constitute the most serious problem in the operation of the pump station/powerhouse facilities. These particular engines have been out of production since 1965, and Nordberg Mfg. Co. is no longer in business. Because of this, the costs of replacement parts is extremely expensive and some parts are virtually unobtainable.

The proposed fast track improvements to the Deer Island Main Pumping Station include the following:

o Empty bay (No. 10) and pump bays (No. 2, 4, 6, and 8) provide:

  - Five new vertical centrifugal pumps, each rated 90 mgd at 105 ft tdh.

  - Four new 2,000 hp synchronous motors, variable speed magnetic coupling drives, and reduced voltage starters. One existing

2,000 hp electric motor and variable speed drive (No. 8) will remain in service.

- One new 8 in. diameter solid steel shaft, bearings and couplings (No. 10).

o Four existing shafts (No. 2, 4, 6, and 8) are proposed to remain in service and be modified to accept new 2,000 hp motors. Condition of existing shafts will be verified by non-destructive testing. Existing bearings will be evaluated and replaced as required. Method of lubricating bearings will be improved. New spacer couplings will be provided to facilitate pump maintenance.

o Existing and new electric driven pumps will be controlled from a new pump control room to be located on the mezzanine level. New 4,160 V motor starters and variable speed drive controllers will be installed in a new electrical room also located at the mezzanine level.

o Five existing Nordberg engines, shafts and pumps (no. 1, 3, 5, 7, and 9) will remain in service. These pumps will continue to be controlled pneumatically from a local panel at each engine. Remote auto-manual, speed, status and alarm conditions will be relocated to a new pump control room by installing P/I converters at the existing graphic panel and transmitting electronic signals to the new control room. The existing control room will be abandoned.

o The existing pneumatic analog pump controller will be replaced with a new electronic analog controller (microprocessor) to accommodate the new electric motor-driven pumps and the new electronic signals from the existing Nordberg engine driven pumps.

o The pump suction piping for the five electric motor driven pumps (No. 2, 4, 6, 8, and 10) will be revised to include a new 60-in knife gate valve downstream from each butterfly valve (one valve on each leg of the wye). They will be installed without dewatering the tunnel system and will protect the pump station against butterfly valve failure in the open position.

o A new 60-in butterfly valve will be installed in the existing discharge piping of pump No. 2, 4, 6, and 8.

o New 60-in steel discharge piping, flow meter and butterfly valve will be installed for the new pump No. 10 (empty bay).

o The new discharge valves will allow the pumps to be started against a closed discharge valve instead of a closed suction

valve, eliminating the cavitation condition that occurs at present. The new discharge valve will be closed just prior to normal shutdown of the pump.

Power And Utilities

The power station generating capability currently consists of five diesel generator sets provided by the Enterprise Engine & Machinery Company of Oakland, CA. The diesels are eight cylinder, in-line type engines that can be operated on digester gas or diesel fuel. The generators are rated at 700 kw each and were furnished by Allis Chalmers.

The five diesel generators are arranged side by side and numbered sequentially from north to south, at the operating floor level (elevation 130 ft). The Enterprise engines are reliable and have good availability.

The proposed fast track improvements to the generating facilities including the following:

- The five existing 700 kw diesels will be rehabilitated (under Diesel Engine Generator Overhaul Contract) and will remain in service.

- Install two new 6,000 kw dual fuel diesel engine/generator sets in a new building addition. New diesel engines will be started/ stopped locally at each diesel and controlled from a new control panel in the switchgear room. Alarm and status indicators will be located at diesels, in switch-gear room, and in the new Pump Control Room.

- A new power distribution arrangement will allow the diesels to operate in parallel or be separated (5 existing diesels on one bus and 2 new diesels on another bus). In general, the two new diesels will power the electric-driven raw sewage pumps and the existing diesels will power all plant loads.

- The existing once-through cooling water will be replaced with a closed loop water system with heat rejection through cooling towers. The new system will recover heat from the jacket water of the Enterprise engines, the new 6,000 kw engines and the remaining Nordberg engines. The heated closed loop water will be routed through heat exchangers to provide heat to the sludge heating water, which in turn will be routed through heat exchangers to heat sludge at the digesters.

Treatment Facilities

Flows from the Main Pump Station and the Winthrop Terminal are discharged to two preaeration channels which also serve as distribution channels to the eight primary sedimentation tanks.

Sewage is conveyed from the Main Pump Station and Winthrop Terminal to the primaries via a 20-foot-wide by 14-foot-deep concrete channel which flows full. This channel splits into two 10-foot-wide by 14-foot-deep aerated channels, each of which feeds one-half of the primary tanks. Either of these channels can be isolated from the main influent channel by means of large motor operated sluice gates.

The two aerated channels are furnished with one stationary air diffuser and 22 swing arm diffusers each. Positive displacement compressors for these diffusers are located in the Winthrop Terminal Headworks.

From the aerated channels, wastewater is fed into each settling tank through ten manually operated or portable motor operated 24-inch by 42-inch sluice gates (downward operating). There are eight primary settling tanks at Deer Island. Each tank is approximately 100 feet wide by 240 feet long with an average side water depth of 11.35 feet. The tanks are equipped with traveling bridge collectors and chain and flight crosscollectors. Each tank has approximately 100 feet of straight-edge weir at its effluent end from which settled sewage falls into the effluent channel.

Traveling bridge collectors push scum to the effluent end of the tanks where the bridge pauses for a period of time while a reciprocating scum collector travels back and forth across the width of the tank and pushes scum over a V-notch weir on either side of the tank. Scum from all eight tanks flows to a central sump located between Tank Nos. 4 and 5 from where it is pumped to scum thickeners. Sludge is pushed to the influent end of the primary tanks to the cross-collector hopper where it is moved to one end by a chain and flight collector. Sludge is withdrawn from the hopper by 12 sludge pumps, three for each pair of primary tanks.

The westernmost aerated influent channel of the settling tanks has substantial accumulations of grit, nearly reaching the water surface at the downstream end at the time of recent inspection. This may be caused by the poor condition of the swing diffusers which have never been replaced, higher concentrations of grit to the westernmost channels due to hydraulic anomalies, lack of sufficient mixing air, poor upstream grit removal, or all of the above.

The swing diffusers are in poor condition. Those in the easternmost channel were replaced several years ago and are operable but have serious corrosion problems, with holes completely through the pipe in some places. Those in the westernmost channel are original equipment, and are in very poor condition. These diffusers create little visible turbulence and are covered with grit. Plug valves for the diffusers are rusted and some are stuck in the open position.

The inlet sluice gates and inflet baffles to the primary tanks are in poor condition. The sluice gates are opened and closed manually or by portable electric operators. The portable operator sometimes causes the gates to be opened or closed too far, creating high stresses on the gate itself or on the anchoring system. Half of the 80 gates show evidence of these problems. Five gates cannot be fully closed, making dewatering difficult. Maintenance of the sluice gates is hampered by their location on the aeration channel side of the wall (seating head). This means that for adjustments to be made on any one gate, one-half of the plant's primary treatment capacity must be removed from service. Each sluice gate has a steel inlet

baffle just downstream on it, inside the tank. These baffles are severely corroded and some are completely missing.

Dewatered basins have reportedly experienced leakage through several expansion joints from full basins into emptied basins. It is not known at this time how many of the basins are affected or to what degree of severity the leakage occurs.

The water level in the effluent channel from the primary tanks was originally maintained by a tainter gate in order to provide chlorine contact time. A few years after start of operation, this gate became inoperable. As a result of this, the water level in the channel is now below the elevation of the scum sump float valve and it is inoperable.

Currently, one scum pump is continuously operating with the scum collection V-notches set to match this flow as closely as possible. However, the pump normally pumps slightly more than this, and lowers the water level in the sump until the pump begins taking air.

The scum collection system has proven to be a problem, particularly in winter months. Scum begins freezing at the V-notch weirs and if not broken up and manually pushed over the weir, the buildup begins extending out into the tank. This situation is difficult to overcome because the scum collecting mechanism must be started manually and thus does not clean the surface every time the traveling bridge delivers a load of scum. Further, the remote and exposed location of the scum collectors does not encourage manual attention, particularly during severe weather when attention is most required. In the past, this problem has often proven disastrous, bending scum collectors on the traveling bridges and sometimes becoming so severe that tanks have had to be removed from service.

The following problems have been reported with the operation of the sludge pumping station:

1. All of the Homestead crossover valves on the primary sludge pump intakes are frozen in either open or shut positions. Consequently, the middle pump at each station is available as standby for only one of the two tanks.

2. All of the sump pumps at the primary sludge pumping stations have either been removed or are inoperable. None of the pumps has worked for about 10 years. As a result, the crossover valves are usually submerged.

3. There are no check valves on the primary sludge pump discharge pipe.

4. The water seal glands and piping are corroded and in poor condition for all 12 primary sludge pumps.

5. For most of the primary sludge pumps, the coupling guard protection is gone.

6. Most of the primary sludge pump pressure gauges are rusted out. and none work.

The electrical power system and controls for many of the traveling bridge collectors are in

poor condition. Much of the electrical conduit is badly rusted and most of the timers for short-and medium-pass bridge travel modes are inoperable or removed. Some chain and sprocket guards for the traveling bridges are badly rusted.

Turnbuckles and cables used for raising and lowering the sludge and scum collector blades are a constant problem because of corrosion and breaking. Cable and turnbuckles often break. When this occurs, the sludge scraper falls to the bottom of the tank and often becomes bent.

Originally, the traveling bridges were supplied power by bus bar. This caused severe problems during cold or wet weather, and the system was replaced with festooned cable. The cable has proven fairly reliable, except that occasionally a cable ring breaks and drops the cable to the rail where it is cut by the bridge wheel, putting the unit out of service.

The proposed fast-track improvements program at the Deer Island Primary Treatment Facilities includes the following components:

o Replacement of all 80 influent sluice gates and baffles to the primary tanks

o Replacement of the sludge collectors and travelIng bridge drives and hoists

o Rehabilitation of the traveling bridges

o Installation of new scum collection and pumping systems.

Disinfection is provided to the plant effluent using gaseous chlorine. Chlorine can be used to disinfect plant effluent, for pre-chlorination just prior to the primary tank preaeration channels, for pre-chlorination of influent flows to the Winthrop Terminal Headworks, and for disinfection of non-potable plant water.

Chlorine is delivered to the Deer Island Plant in two 16-ton tanker trucks which are stored in the chlorine storage room. Each chlorine tanker truck is located on a separate weigh scale. Chlorine is withdrawn from the tankers and piped to a separate chlorine feed room which houses seven evaporators and seven chlorinators. Injectors are operated by non-potable plant process water and booster pumps. The injectors pull chlorine from the chlorinators under vacuum and inject it at the various application points.

The existing chlorination system is at the end of its useful life. The following problems were observed:

1. The liquid chlorine supply lines are severely corroded. Availability of wrenches and safety equipment to make the supply line connection with the tanker truck dome valving should be improved.

2. Some of the overhead doors to the garage have deteriorated to the point where they do not open or do not close. Some windows are inoperable.

3. The chlorine supply island should be provided with an additional escape route to be used when a chlorine leak has occurred.

4. The HVAC for the garage does not work.

5. Parts for original chlorinators are difficult to obtain or are unobtainable.

6. The automatic controls for the chlorination equipment do not always function properly.

7. The chlorine gas detection system is antiquated and does not tell the operator where the leak has occurred. This detection system does not detect leaks in every room in which chlorine is handled.

8. Chlorine solution piping and valving is in extremely poor condition. Some injectors have developed leaks.

9. The solution piping to pre-chlorination is currently disconnected, reportedly because it developed a leak in a buried section.

10. There is sometimes inadequate vacuum produced by the injectors to operate the chlorinators.

11. The chlorine diffusion system in the primary sedimentation effluent channels was recently replaced and is in good condition.

The Deer Island Fast Track Improvement program includes replacement and upgrading of the chlorination system.

6.2 EXISTING ENVIRONMENT

6.2.1 PHYSIOGRAPHY AND GEOLOGY

Physiography

The dominant topographic and geologic feature on Deer Island is the central drumlin which crests at approximately elev.210. The major axis of the drumlin is oriented east-west and extends approximately 2,000 ft with a minor axis of about 1,000 ft. Another smaller, partially eroded drumlin is located at the north shore of the island and stands at a maximum elev.170. The small drumlin is believed to have been just as large as, and oriented roughly parallel to, the central drumlin; however, due to significant erosion along the seaward side, the major axis of this drumlin is currently oriented northwesterly and extends approximately 1,400 ft with a minor axis of about 400 ft. The remnant of a third drumlin is barely perceptible at the southernmost tip of the island. This feature shows little topographic expression and no longer presents a distinctive form.

The processes of weathering and erosion have significantly modified the structure of the island. It was during a severe hurricane in 1936 that the channelway known as Shirley Gut was closed off by wind and current action. At this time Deer Island became, in actuality, a peninsula of the mainland. Wave action has severely affected the northern and eastern shorelines to the point that a seawall was erected to suppress the degradation. Similarly, tidal currents have remolded and redeposited glacial sediments in the formation of a sand and gravel extension of the island southward toward President Roads.

Man-made features have necessarily altered the contours of the island over the years. Construction of the existing sewage treatment facility required removal of part of the central drumlin along the northwest flank. In addition, a water reservoir was constructed at the crest of this drumlin. A swamp/tidal marsh area north of the central drumlin was backfilled to facilitate construction of the existing treatment plant. Fill materials have also been placed along roadways, particularly along the western shore of Deer Island. Excavation spoil or "tunnel muck" from previous shaft excavations has also been placed along an area of the western shoreline near the existing treatment facility. Approximately 600 ft south of the central drumlin, near the eastern shore of the island, stands a man-made earthen bunker formerly used by the military as part of the coastal defense system. This structure is elongate in a north-south direction extending about 700 ft with a minor axis of approximately 250 ft. The maximum relief is about 40 ft above the surrounding topography.

Geology

The Deer Island drumlins were deposited by the retreating glacier onto a very compact unit of clay, sand, gravel, and boulders, which in turn overlies an irregular bedrock surface. Flanking the slopes of the drumlins are marine deposits and stratified glacial drift. These consist chiefly of a marine clay overlain by sand and gravel outwash containing occasional lenses of glacial till. The uppermost unit consists of more recent deposits of silty fine-to-medium sand with some traces of organic material. The bedrock is predominantly

argillite and is persistent throughout the area of the island.

Surficial Deposits. A dense to very dense mixture of clay, silt, sand, gravel and boulders (glacial till) covers the bedrock surface and comprises the drumlins on Deer Island. Till thicknesses approaching 200 ft have been noted in the area of the central drumlins. As is typical of glacial till deposits, the proportion of this coarse- to fine-grained material is highly variable. However, isolated pockets and lenses of near-homogeneous fine materials occur throughout the tills. The remaining land area soils, adjacent to and between the drumlin exposures, consist of a gray silty clay and are generally overlain by sand and gravel outwash deposits. The clays vary in thickness, becoming thicker near the shoreline and reaching a maximum thickness of 50 ft, whereas the sands and gravels generally range from 0 to 20 ft in thickness.

Organic silts, peat and muck have been observed in borings in low lying areas between the drumlins. This occurrence would be indicative of the formation of a tidal marsh or backswamp during a period of lower sea level. A subsequent rise in sea level permitted deposition of the fine sand and gravel associated with the more recent beach deposits.

Bedrock Geology. Like much of the Boston Harbor area, Deer Island is underlain by slightly metamorphosed and often complexly folded and faulted argillite. This is generally very thinly bedded, laminated to occasionally non-bedded fine grained rock characterized as the Cambridge Formation of the Boston Basin Group. Bedding or laminations are quite prominent as alternating light and dark gray bands which generally dip 25° to 50° from the horizontal. Fractures (partings) in the rock are generally observed parallel to the laminations. The rock is well indurated and, with few exceptions, is moderately-hard to hard. Unconfined compressive strengths varied from less than 4000 psi to greater than 35,000 psi with average values of 15,000 - 20,000 psi. Based on borings and a seismic refraction survey, the topographic relief of the bedrock surface varied from approximately elev. +30 beneath the central drumlin to elev.-40 along the western side of the island.

Due to the complex sedimentary and structural historey of the harbor area, other rock types are often found interlayered with, faulted into, or intruded into the argillite. Other rock types associated with the Boston Basin Group include tuffs, sandstone, quartzite and conglomerates in addition to intrusions by dikes and sills of diabase, basalt and/or andesite. At Deer Island the only known occurrence of rock other than argillite is that of a basalt sill found at tunnel level near the vertical shaft to the Main Drainage Tunnel. However, this does not preclude the existence of other bedrock types on the island.

6.2.2 SURFACE AND GROUNDWATER HYDROLOGY

Surface Water

As described in section 6.2.1, the natural contours of Deer Island have been significantly altered over the years. There are no natural surface water bodies on Deer Island. Man-made surface water features consist of the existing primary treatment tanks and a three million gallon cooling water reservoir located at the top of the central drumlin. Rainfall runoff in

the developed areas of the prison and the treatment plant is either collected by roads/catch basins and drained to the harbor, or is collected and discharged to the harbor via the treatment facility. Rainfall runoff in all other areas of Deer Island is discharged to the harbor via natural swales or drainage areas.

The wastewater treatment plant and Fort Dawes, located at the southern end of Deer Island, have created shoreline protection and alterations such as riprap, groins, seawalls, and piers. These shoreline alterations nearly encompass Deer Island.

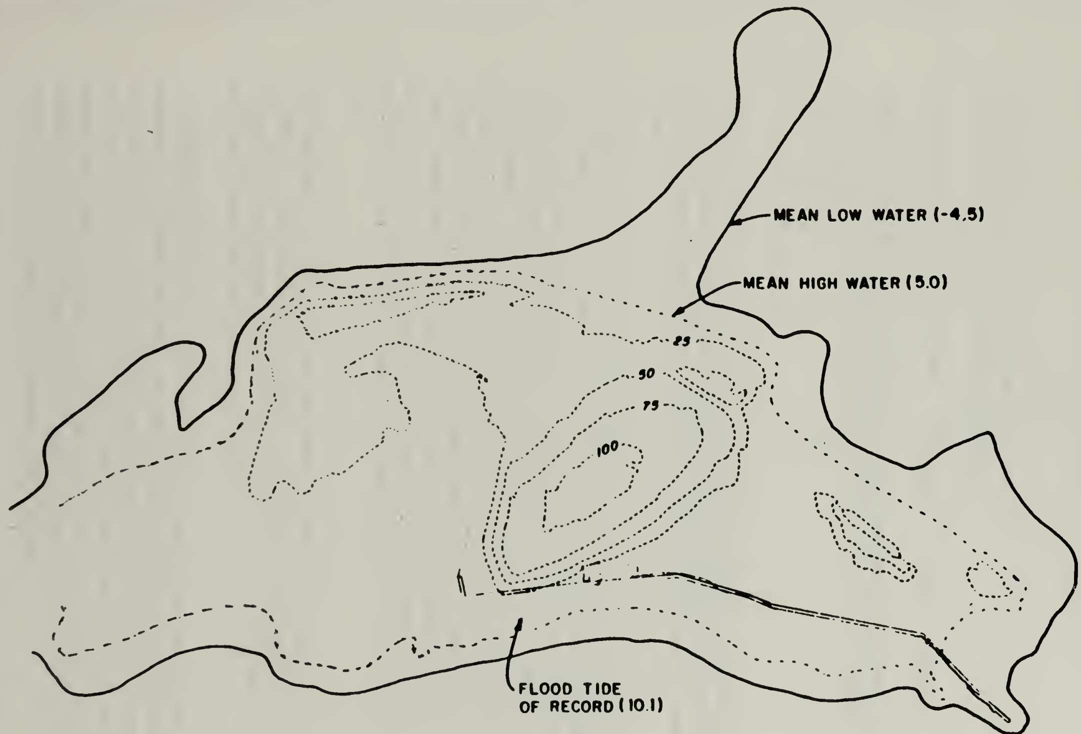
Figure 6.2.2-1 identifies the locations of flood tide of record, mean high water, and mean low water, relative to USGS datum. The 100-year flood elevation is obtained from the Federal Emergency Management Agency. All other elevations are obtained from a study prepared for the City of Boston (CDM, 1967). Comparison of these elevations with the MDC sewer datum (MDCSD) is as follows:

	Elevation, ft, MDCSD	Elevation, ft, USGS
Flood tide of record	115.7	10.1
100-year flood	115.6	10.0
Mean high water	110.6	5.0
Mean sea level	105.6	0.0
Mean low water	101.1	-4.5

Groundwater Hydrology

As indicated above, mean sea level at Deer Island is at 105.6 ft. In the low-lying areas adjacent to and between the drumlins of Deer Island, groundwater levels generally vary between elevation 108 to 114 ft, approximately 8 to 11 ft below ground surface. (Metcalf and Eddy, 1983; CDM, 1986).

At the central drumlin there appears to be a perched water table that generally follows the contour of the drumlin. Here the water table lies within a sandy, clayey, gravel (till) at depths varying between 10 to 30 ft below the ground surface. Near the crest of the drumlin the water table may be at an approximate elevation of 172 ft. Storage and recharge capacities are thought to be limited due to the dense and impervious nature of the till.



NOTE:
ELEVATIONS ARE FT., USGS DATUM

MASSACHUSETTS
WATER RESOURCES
AUTHORITY

FIGURE 6.2.2-1

EXISTING DEER ISLAND TOPOGRAPHY

Section 6.2.2 References

Camp Dresser & McKee,. September, 1967. Report on Improvements to the Boston Main Drainage System, Volume I, HUD Project No. P-Mass-33-6.

Metcalf & Eddy, Inc.,. April, 1983. Draft Geotechnical Report - Site Options Study,

Camp Dresser & McKee,. October, 1986. Field Investigations and Interim Closure Design Plant and Report for Grit and Screenings Disposal Areas On Deer Island - Appendix A, Groundwater Well Boring Logs.

6.2.3 METEOROLOGY

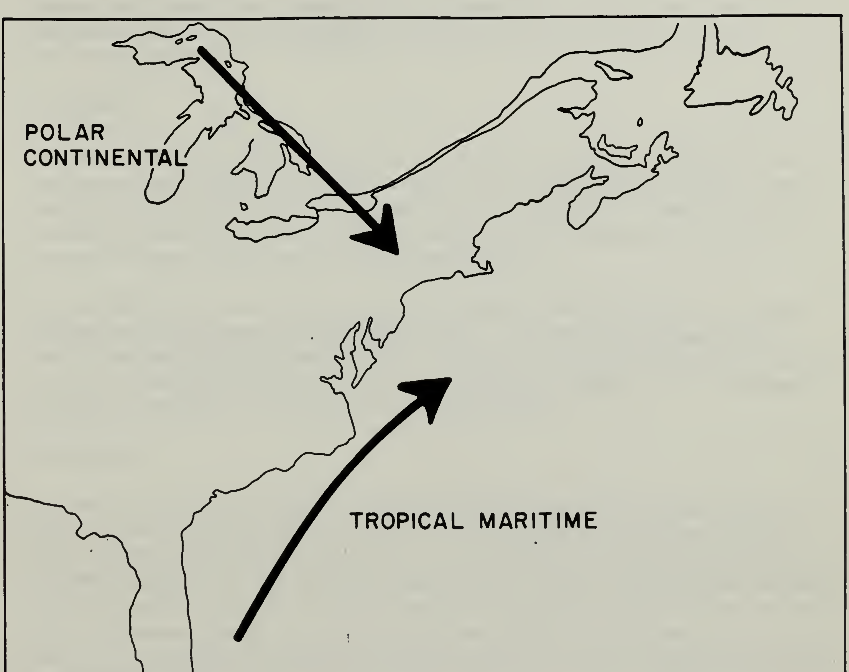
The climate of the Deer Island area is best described using long-term representative meteorological data collected at the National Weather Service Office at Logan International Airport in Boston, Massachusetts. The airport is located approximately 1.2 miles west of Deer Island.

The climate of the region is continental; however, the Atlantic Ocean has a significant moderating effect. Sea breezes occur on hot spring and summer afternoons, displacing the warm, westerly airflow with a cool, moist east wind off the water. These breezes generally develop several hours after sunrise and persist for most of the afternoon. The region is situated near 42° N latitude, in the prevailing westerlies, and the weather undergoes alternating intrusions of tropical and polar air masses. In the early fall, hurricanes can bring destructive winds to the area. From late October to late April, major east coast storms bring significant rain and snow. During the warmer season, May through September, rainfall is mostly limited to showers and thunderstorms which accompany frontal passages. Thunderstorms occur on an average of 19 days during the year. On the average, precipitation occurs 1 out of 3 days throughout the year.

New England is affected by high and low pressure systems which originate from areas of North America that differ significantly in climate. The direction of air flow and duration of a particular air flow direction over New England depends on the track (relative to New England) and speed of these high and low pressure systems.

Two types of high pressure systems or air masses frequently affect New England: polar continental and tropical maritime. The general tracks of these two types of systems are shown in Figure 6.2.3-1. A polar continental high pressure system originates in the polar region of the North American continent. This type of system affects New England during all seasons and usually brings dry, abnormally cold air with partly cloudy sky conditions. The tropical maritime high-pressure system originates from the tropical region of the Atlantic Ocean and usually imports abnormally warm humid air to New England.

Low pressure systems which affect New England generally move from the west or the south, as



MASSACHUSETTS WATER RESOURCES AUTHORITY	FIGURE 6.2.3-1 GENERAL MOVEMENT OF AIR MASSES WHICH FREQUENTLY AFFECT NEW ENGLAND

shown in Figure 6.2.3-2. Winter low pressure systems are larger and more intense than summer systems and tend to track up the Atlantic seacoast. Flows off the ocean, affecting all of New England for extended periods of time, are usually the result of the counterclockwise flow around a low pressure system passing to the east of New England. Low pressure systems which originate in the center of the United States are usually drier and less intense than coastal low pressure systems.

Precipitation

The annual average precipitation in Boston for the period of 1943 through 1982 was 41.40 inches with amounts ranging from as low as 23.71 inches in 1965 to as high as 62.32 inches in 1954. A maximum 24-hour rainfall value of 8.40 inches occurred in August 1955. Table 6.2.3-1 lists minimum and maximum monthly precipitation statistics for Boston, Massachusetts. Table 6.2.3-2 presents the average monthly and seasonal precipitation values.

The first measurable snowfall of winter usually occurs about the end of November, and the last snowfall in spring is generally near the middle of March. The average annual snowfall is 42 inches, with amounts ranging from as low as 10.3 inches in 1972-1973 to as high as 89.2 inches in 1947-48. Average monthly snowfall values are also presented in Table 6.2.3-2. A monthly maximum snowfall of 41.3 inches occurred in February 1969.

Temperature

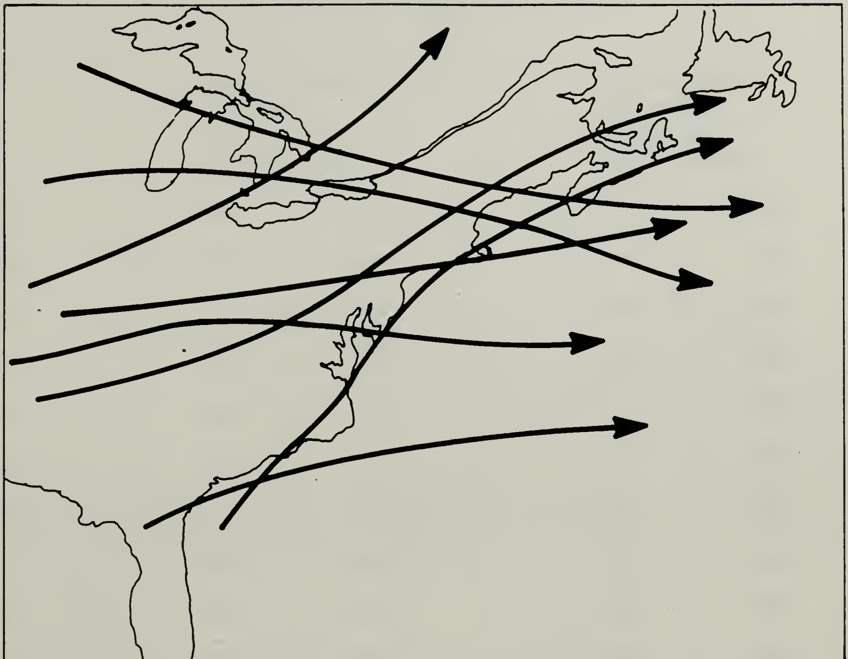
The mean annual temperature is about 50° F, but seasonal variations bring tropical warmth of 90° F or greater in the summer and polar cold of 0° F or less in winter. The coldest months are January and February, averaging about 29° F. The record minimum temperature of -12° F was recorded in January 1957. July and August average near 70° F with a record maximum temperature of 102° F recorded in July 1977. Freezing temperatures occur on an average of 99 days per year from mid-November through March, and very warm days of 90° F or higher average 12 occurrences annually. The average daily maximum and minimum temperature values by month and season are also presented in Table 6.2.3-2.

Fog

Heavy fog is not uncommon in Boston, but usually lasts less than a day. Contrasting temperature differences over the North Atlantic Ocean often create large fog banks which can move inland across southeastern New England any time of the year. The fog can lower visibility to 1/4 mile or less. Such dense fog occurs on an average of two times per month.

Relative Humidity

The annual average relative humidity in Boston is 67 percent. The average of the highest daily relative humidity values is 72 percent. These highest daily values are experienced at night and during early morning hours. The drier afternoon and evening hours average 58 percent and 65 percent at 1:00 p.m. and 7:00 p.m., respectively.



MASSACHUSETTS WATER RESOURCES AUTHORITY	FIGURE 6.2.3-2 TYPICAL TRACKS OF LOW-PRESSURE SYSTEMS AFFECTING NEW ENGLAND

TABLE 6.2.3-1

PRECIPITATION DATA FOR BOSTON
1952-1982

	Minimum Monthly Precipitation in Inches and Year of Occurrence		Maximum Monthly Precipitation in Inches and Year of Occurrence	
Jan	0.74	1980	10.55	1979
Feb	0.88	1980	7.08	1969
Mar	0.62	1981	11.00	1953
Apr	1.24	1966	7.82	1958
May	0.25	1944	13.38	1954
June	0.48	1953	13.20	1982
July	0.52	1952	8.12	1959
Aug	0.83	1972	17.09	1955
Sept	0.35	1957	8.31	1954
Oct	0.34	1946	8.68	1962
Nov	0.64	1976	8.18	1969
Dec	0.97	1980	9.74	1969

Minimum yearly precipitation: 23.71 inches (1965)
Maximum yearly precipitation: 62.32 inches (1954)
Average yearly precipitation: 41.40 inches

SOURCE:

Department of Commerce, 1982. National Oceanic and Atmospheric Administration: Local Climatological Data, Annual Summary with Comparative Data, 1982, for General Logan International Airport, Boston, Massachusetts.

TABLE 6.2.3-2

MONTHLY AND SEASONAL CLIMATIC SUMMARY OF BOSTON, MASSACHUSETTS

	Average Daily Maximum Temperature 1941-1970 (oF)	Average Daily Minimum Temperature 1941-1970 (oF)	Average Precipitation 1943-1982 (inches)	Average Snowfall 1943-1982 (inches)	Average Wind Speed 1958-1982 (mph)
December	39.3	26.6	3.65	8.0	13.6
January	35.9	22.5	3.67	12.6	14.2
February	37.5	23.3	3.38	11.6	14.0
Winter	37.6	24.1	10.70	32.2	13.9
March	44.6	31.5	3.79	7.7	13.8
April	56.3	40.8	3.55	0.9	13.5
May	67.1	50.1	3.23	Trace	12.1
Spring	56.0	40.8	10.57	8.6	13.1
June	76.6	59.3	3.17	0.0	11.4
July	81.4	65.1	3.13	0.0	10.8
August	79.3	63.3	3.57	0.0	10.7
Summer	79.1	62.6	9.87	0.0	11.0
September	72.2	56.7	3.18	0.0	11.2
October	63.2	47.5	3.25	Trace	12.0
November	51.7	38.7	3.83	1.2	12.9
Fall	62.4	47.6	10.26	1.2	12.0

SOURCE:

Department of Commerce, 1982. National Oceanic and Atmospheric Administration: Local Climatological Data Annual Summary with Comparative Data. 1982, for General Logan International Airport, Boston, Massachusetts.

Wind Speed and Wind Direction

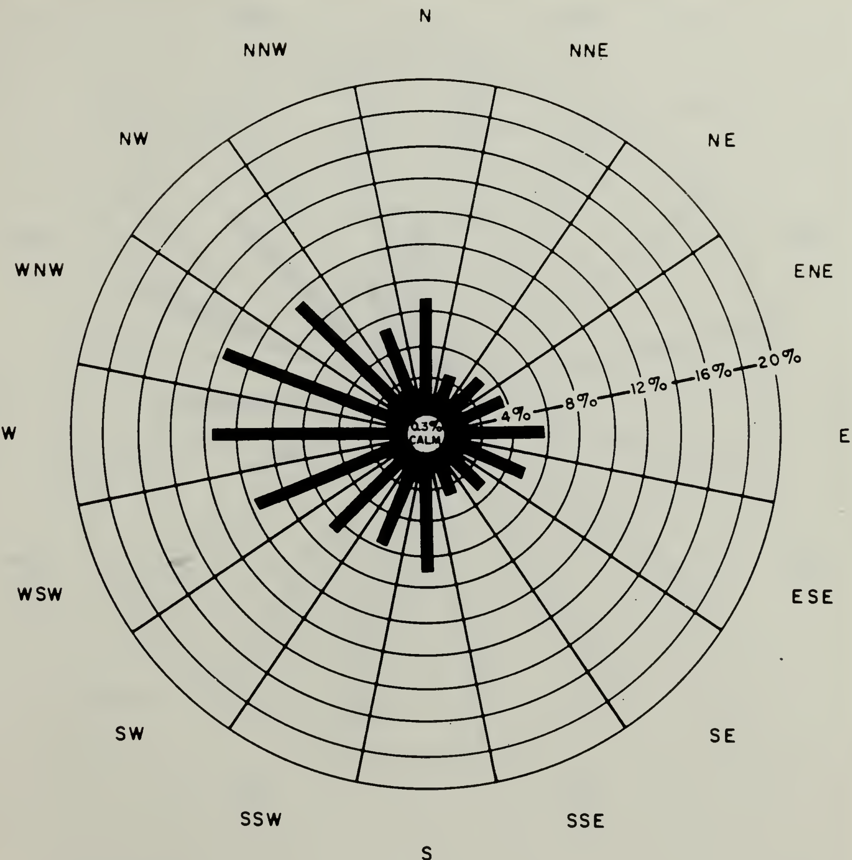
Figure 6.2.3-3 depicts the annual frequency distribution of wind direction at Boston. The most frequent (11.8 percent) wind direction is west-northwest and the least frequent (2.3 percent) wind direction is south-southeast. Figures 6.2.3-4 through 6.2.3-7 present the seasonal frequencies of wind direction at Boston. During the winter season, (December - February), the wind is predominately from the west-northwest, with the winds blowing from the west through (clockwise) northwest approximately 45 percent of the time. During the spring (March - May), the most frequent (11.5 percent) wind direction remains west-northwest. However, the frequency of wind directions from the northeast through (clockwise) southeast is significantly increased from winter because of the sea breeze phenomenon. The most prevalent (11.4 percent) wind direction during the summer is west-southwest, with the winds blowing from the south through (clockwise) west almost half (48 percent) of the time. The effect of the sea breeze on the summer frequency distribution is evident with a pronounced secondary maximum (19.5 percent) occurring between east and southeast. During the fall, the prevalent (10.6 percent) wind direction is west.

The annual average hourly wind speed is 12.5 mph. Calm conditions are infrequent (0.3 percent). Average monthly wind speeds are summarized in Table 6.2.3-2. Wind speeds are highest during the winter, reflecting the increase in the frequency of intense storms affecting New England. Wind speeds are lowest during the summer,which is the period that lacks organized large-scale storm activity, although short duration high wind gusts can occur during this season as a result of localized thunderstorm activity.

Table 6.2.3-3 presents seasonal and annual wind speeds per wind direction. A west-northwest wind direction is associated with the highest annual average wind speed of 13.9 mph and a south-southeast wind is associated with the lowest annual average wind speed of 8.5 mph. These directions correspond with the highest and lowest average wind speed directions of the winter season. During the summer, a south-southwest wind is associated with the highest wind speed of 11.7 mph.

6.2.4 AIR QUALITY

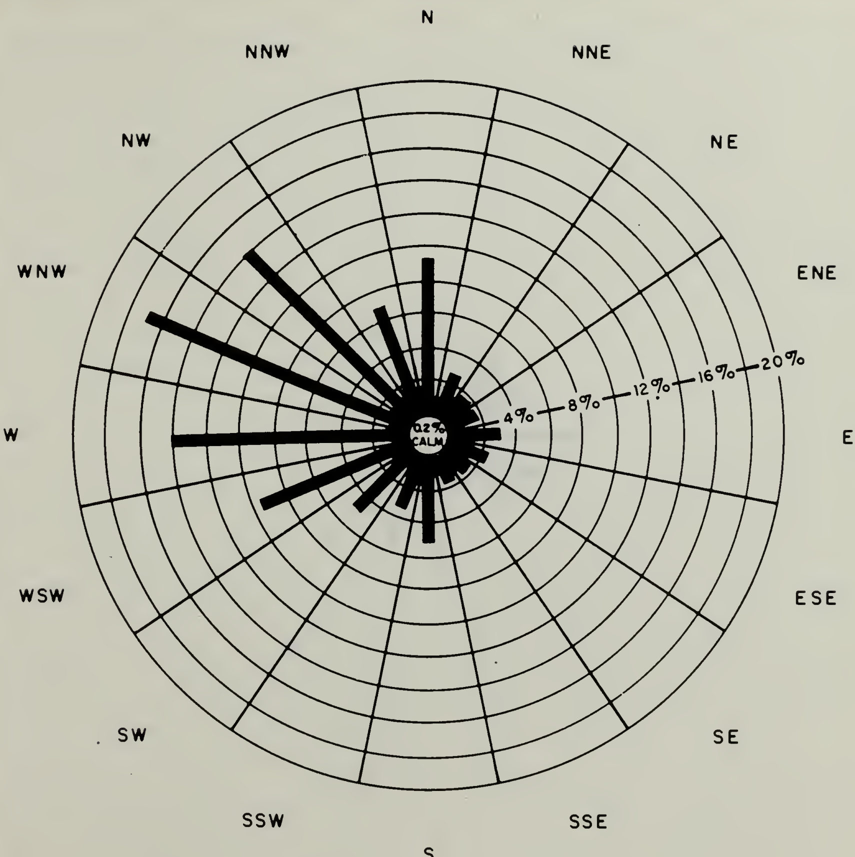
Federal and state air pollution control to date has focused on the six major pollutants for which National Ambient Air Quality Standards (NAAQS) have been established in accordance with the Clean Air Act (CAA) and its 1977 amendments. Known as the "criteria pollutants", the NAAQS include total suspended particulates (TSP), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (0_3), and lead (Pb). Non-methane hydrocarbon standards were revoked on January 5, 1983 [48FR628]. Primary standards are intended to safeguard human health by setting limits on the amount of pollution allowed in the surrounding air so as to protect the population with a significant margin of safety. The margin of safety is to ensure protection of more sensitive groups such as children, the elderly, and the ill. Secondary standards are meant to protect public welfare by preventing adverse effects on animals, agricultural crops, man-made materials and property, personal comfort and well being, and other factors. The degree of stringency of the primary standards, as opposed to the secondary standards, is dependent upon results of extensive health analyses.



NOTE
DIRECTION REPRESENTS SECTOR FROM WHICH THE WIND BLOWS

SOURCE: National Climatic Center
Asheville, NC.

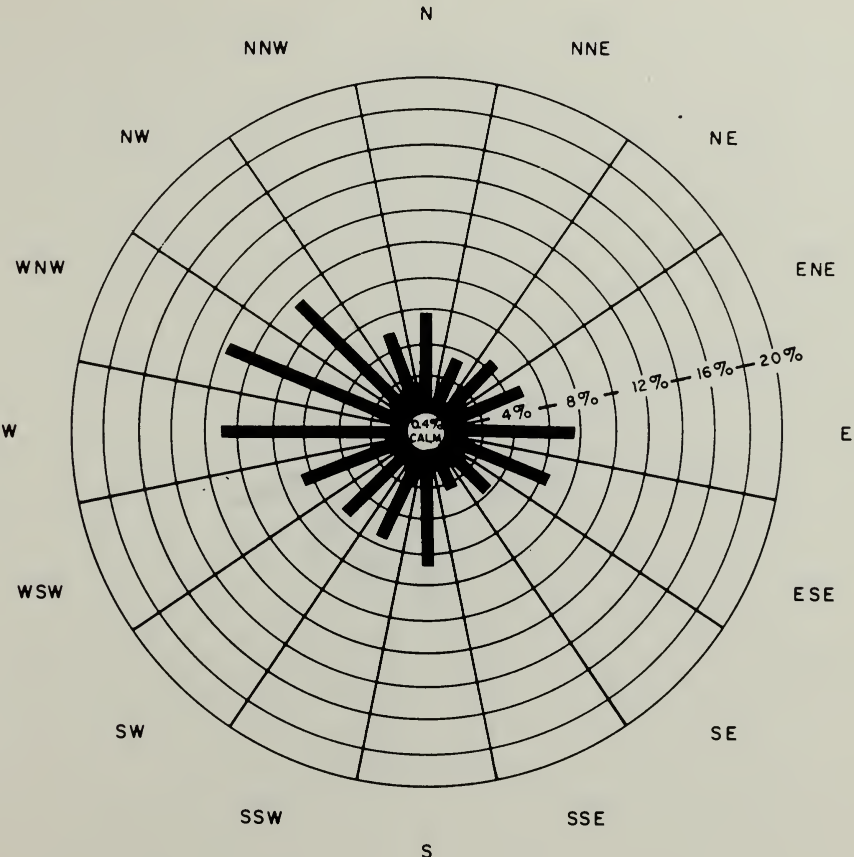
MASSACHUSETTS WATER RESOURCES AUTHORITY	FIGURE 6.2.3-3 ANNUAL FREQUENCY DISTRIBUTION (PERCENTAGE OCCURRENCE) OF WIND DIRECTION FOR BOSTON, MASSACHUSETTS (1970-1981)



NOTE
DIRECTION REPRESENTS SECTOR
FROM WHICH THE WIND BLOWS

SOURCE: National Climatic Center
Asheville, NC.

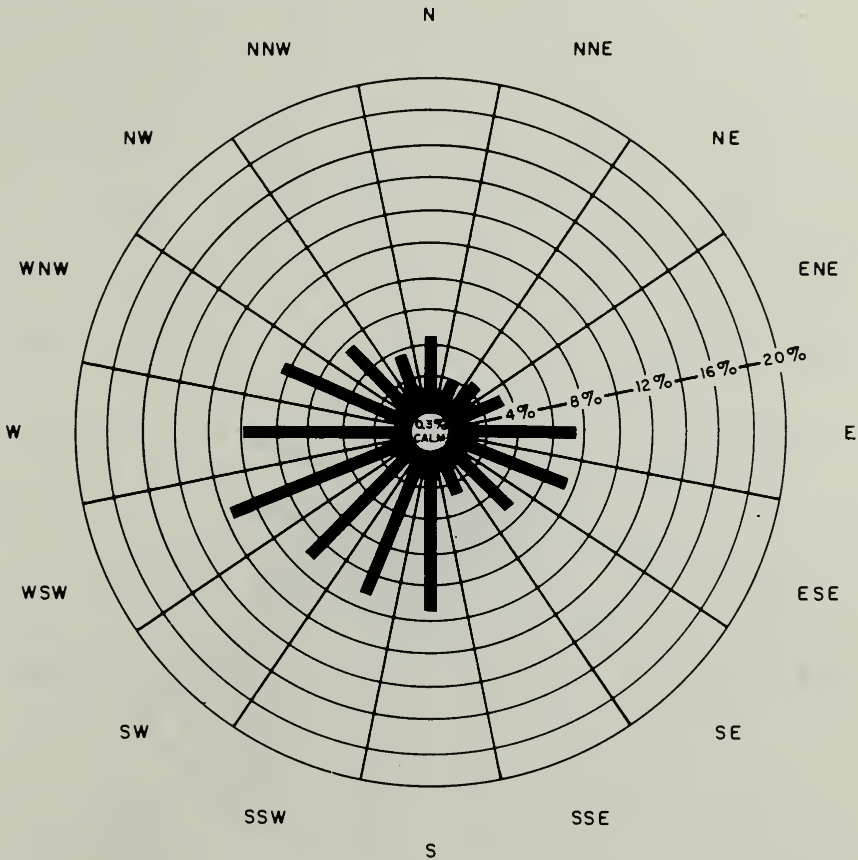
MASSACHUSETTS WATER RESOURCES AUTHORITY	FIGURE 6.2.3-4 WINTER FREQUENCY DISTRIBUTION (PERCENTAGE OCCURRENCE) OF WIND DIRECTION BOSTON, MASSACHUSETTS (1970-1981)



NOTE
DIRECTION REPRESENTS SECTOR
FROM WHICH THE WIND BLOWS

SOURCE: National Climatic Center
Asheville, NC.

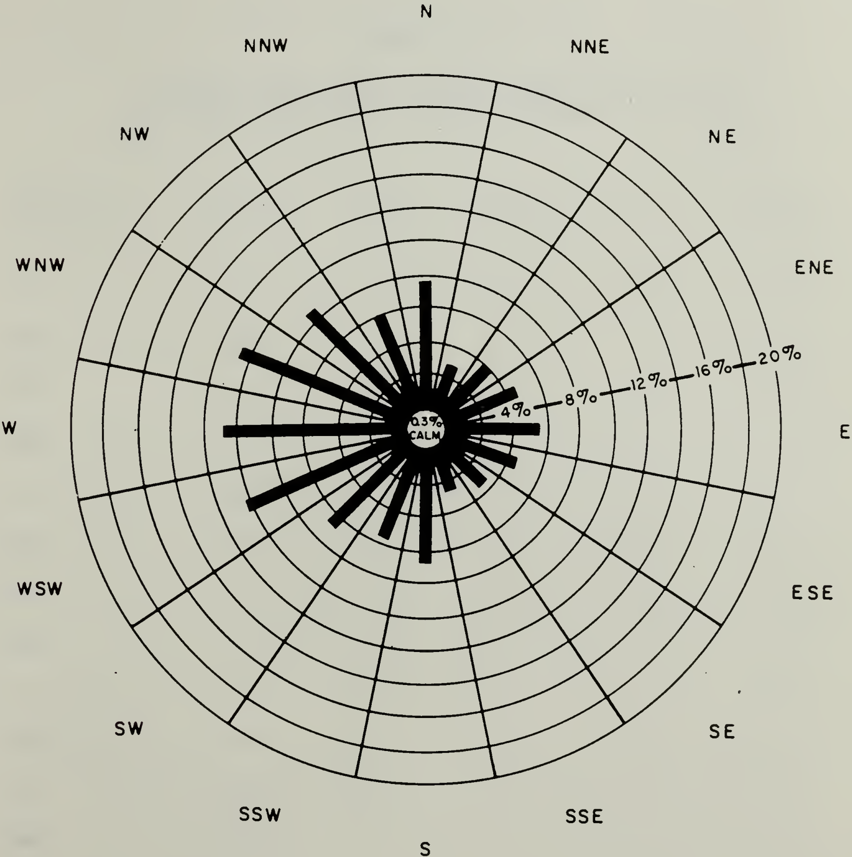
MASSACHUSETTS WATER RESOURCES AUTHORITY	FIGURE 6.2.3-5 SPRING FREQUENCY DISTRIBUTION (PERCENTAGE OCCURRENCE) OF WIND DIRECTION BOSTON, MASSACHUSETTS (1970-1981)



NOTE
DIRECTION REPRESENTS SECTOR FROM WHICH THE WIND BLOWS

SOURCE: National Climatic Center
Asheville, NC.

MASSACHUSETTS WATER RESOURCES AUTHORITY	FIGURE 6.2.3-6 SUMMER FREQUENCY DISTRIBUTION (PERCENTAGE OCCURRENCE) OF WIND DIRECTION BOSTON, MASSACHUSETTS (1970-1981)



NOTE
DIRECTION REPRESENTS SECTOR FROM WHICH THE WIND BLOWS

SOURCE: National Climatic Center
Asheville, NC.

MASSACHUSETTS WATER RESOURCES AUTHORITY	FIGURE 6.2.3-7 FALL FREQUENCY DISTRIBUTION (PERCENTAGE OCCURRENCE) OF WIND DIRECTION FOR BOSTON, MASSACHUSETTS (1970-1981)

TABLE 6.2.3-3

SEASONAL AND ANNUAL AVERAGE WIND SPEED (MPH)
PER WIND DIRECTION AT LOGAN AIRPORT (1970-1981)

Wind Direction	Winter	Spring	Summer	Fall	Annual
N	11.5	10.8	8.6	10.0	10.4
NNE	10.3	11.1	8.5	9.7	10.0
NE	12.5	12.9	10.5	12.0	12.0
ENE	14.5	12.0	9.1	11.5	11.5
E	14.0	11.6	9.7	11.0	11.1
ESE	11.5	11.7	10.2	10.3	10.8
SE	9.4	9.0	8.2	9.0	8.8
SSE	9.1	8.9	7.3	8.7	8.5
S	10.9	10.8	9.7	9.9	10.2
SSW	13.2	13.3	11.7	12.0	12.4
SW	13.4	12.7	11.5	12.0	12.2
WSW	13.5	12.1	11.1	12.1	12.1
W	15.4	14.7	11.1	13.5	13.8
WNW	15.5	14.6	11.2	13.0	13.9
NW	14.0	13.3	10.8	12.2	12.9
NNW	12.2	12.4	10.4	11.0	11.6

Under the CAA, individual states must adopt criteria pollutant standards in their State Implementation Plans (SIPs) that are at least as stringent as the NAAQS. Table 6.2.4-1 lists the Massachusetts and National Ambient Air Quality Standards. The primary method of ensuring that the standards are attained and maintained is through the control of the emissions of these pollutants, specifically from mobile and stationary sources.

In addition to criteria pollutants, the CAA requires control of other airborne compounds including radionuclides. Known as "noncriteria pollutants", regulation of these substances has been more difficult to achieve. This is due largely to the uncertainty of the origin of their emissions, the atmospheric chemistry involved during transport, and the significance, if any, of their health effects. Emissions standards for some of the noncriteria pollutants have been established (40CFR61) and are known as the National Emission Standards for Hazardous Air Pollutants (NESHAP). These hazardous air pollutants include asbestos, beryllium, mercury, and vinyl chlorides. The intent of NESHAP is to provide nationally uniform control requirements through specific emission limitations, work practices, and/or equipment standards. The NESHAP control requirements are set at a level that provides an ample margin of safety to protect the public health.

Determination of progress being achieved in attaining and/or maintaining the NAAQS is accomplished through ambient air quality monitoring. Under the CAA, the state must provide for ambient air quality monitoring at selected locations within specified areas under its jurisdiction, known as Air Quality Control Regions (AQCRs). The state must make available on an annual basis the present ambient conditions on a pollutant-specific basis. In addition to the state-operated network, ambient monitoring data are also collected by local agencies, corporations, universities, etc.

Deer Island is located in the state-designated Metropolitan Boston Air Pollution Control District and the federally designated Metropolitan Boston Air Quality Control Region 119 (AQCR). Ambient air quality monitoring data representative of the region surrounding Deer Island were obtained from the Massachusetts Department of Environmental Quality Engineering.

The ambient air quality data presented in this section are essentially inclusive of the period 1981 through 1985 for the criteria pollutants. Table 6.2.4-2 lists monitoring sites, station identification (Storage and Retrieval of Aerometric Data [SAROAD] numbers, operators, pollutants monitored, and Universal Transverse Mercator (UTM) coordinates.

Ambient air quality data summaries are provided below for each criteria pollutant. Existing air quality concentrations are compared to the appropriate ambient air quality standards shown in Table 6.2.4-1. In addition, a summary of the area's attainment status on a pollutant-specific basis is provided in Table 6.2.4-3.

Total Suspended Particulates (TSP)

A summary of TSP ambient air quality data is presented in Table 6.2.4-4. No violations of primary or secondary standards were recorded during the time frame.

TABLE 6.2.4-1
MASSACHUSETTS AND NATIONAL AMBIENT AIR QUALITY STANDARDS

Criteria Pollutant	Averaging (Interval [1])	Primary Standard (ug/m^3)	Primary Standard (ppm)	Secondary Standard (ug/m^3)	Secondary Standard (ppm)
Sulfur Dioxide	Annual	80	0.03	-	-
	24-hr	365	0.14	-	-
	3-hr	-	-	1,300	0.5
Total Suspended Particulate	Annual	75(2)	-	60(2,3)	-
	24-hr	260	-	150	-
Nitrogen Dioxide	Annual	100	0.05	100	0.05
	1-hr	320	0.19	-	-
Carbon Monoxide	8-hr	10(5)	9	10(5)	9
	1-hr	40(5)	35	40(5)	35
Ozone	1-hr(6)	240	0.12	240	0.12
Lead	3-month(7)	1.5	-	1.5	-

NOTES:

1. 1-hr, 3-hr, 8-hr, and 24-hr standards not to be exceeded more than once per year. Arithmetic mean for 3-month and annual standards except particulate matter.

2. Annual geometric mean.

3. For use as a guide in assessing implementation plans to achieve the 24-hr standard.

4. Massachusetts Department of Environmental Quality Engineering guideline, applicable only to major sources or major modifications of oxides of nitrogen.

5. Carbon monoxide standards are shown in units of mg/m^3.

6. Standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above standard is equal to or less than one.

7. Maximum arithmetic mean average over a calendar quarter.

TABLE 6.2.4-2

AMBIENT AIR QUALITY MONITORING STATIONS

Monitoring Site (SAROAD No.)	Operated By	Pollutant(s) Monitored	UTM Coordinates X	UTM Coordinates Y
1. Deer Island Boston (0240-026)	DEQE	SO_2, NO_2	337.9	4690.2
2. Atlantic Ave Boston (0240-018)	BECO	TSP, SO_2, SO4	30.8	4690.8
3. Long Island Boston (0240-019)	BECO	TSP, SO_2, SO4	337.6	4686.6
4. Bremen St. East Boston (0240-021)	DEQE BECO	TSP, SO_2, NO_2, C0,0_3 TSP, SO_2, SO_4	332.7	4693.4
5. Chestnut and 6th Chelsea (0380-002)	DEQE	TSP, Pb	332.5	4695.1
6. Power Horn Hill (0380-003)	DEQE Chelsea	SO_2, NO_2, O_3	339.9	4675.8

TABLE 6.2.4-3

ATTAINMENT STATUS DESIGNATIONS OF AQCR 119

Criteria Pollutant	Area	Status
TSP	Boston	Cannot be classified or better than national standards
SO_2	Entire State	Better than national standards
NO_2	Entire State	Cannot be classified or better than national standards
CO	Boston	Does not meet primary standards
O_3	Entire State	Does not meet primary standards
Pb	Entire State	Currently no designations

TABLE 6.2.4-4

AMBIENT AIR QUALITY DATA SUMMARY
FOR TOTAL SUSPENDED PARTICULATES

Monitoring Site	Year	24Hr Average Concentration Highest (ug/m^3)	24Hr Average Concentration 2nd Highest (ug/m^3)	Annual Geometric Mean (ug/m^3)
Atlantic Ave	1981	---	---	---
Boston	1982	---	---	---
	1983	---	---	---
	1984	177	139	56
	1985	---	---	---
Long Island	1981	---	---	---
Boston	1982	---	---	---
	1983	---	---	---
	1984	50	49	25
	1985	---	---	---
Bremen St	1981	---	---	---
East Boston	1982	---	---	---
	1983	100	95	52
	1984	107	97	40
	1985	---	---	---
Chestnut and 6th	1981	149	128	57
Chelsea	1982	118	104	50
	1983	127	106	50
	1984	125	118	54
	1985	---	---	---

No ambient data depicting the TSP concentrations in the immediate vicinity of Deer Island are presently available. TSP concentrations recorded in 1981 through 1985 at the nearby Long Island monitoring station, located less than 2 miles from Deer Island, were in compliance with all standards.

In a study performed in 1977 to determine the elemental composition of TSP in metropolitan Boston, it was reported that between 51 and 59 percent of all particulates originate from the soil and are entrained into the atmosphere by vehicle activity, construction and demolition, and the action of the wind (Wiltsee 1977). In addition, it was determined that the burning of residual oil fuel for power generation from all sources contributes only 2 to 5 percent of the TSP concentrations in metropolitan Boston.

Sulfur Dioxide (SO_2)

Ambient monitoring data for SO_2 are summarized in Table 6.2.4-5. There were no violations of either the 3-hour, 24-hour, or annual ambient standards of 1300 micro-grams per cubic meter (ug/m^3), 365 ug/m^3 and 80 ug/m^3, respectively, at any site in the vicinity of Deer Island during the period from 1981 through 1985. It is clear that SO_2 concentrations in the vicinity of Deer Island are well within all standards.

An evaluation of the trends of $S0_2$ concentrations in metropolitan Boston shows that regional levels fell consistently from 1971 to 1974, with the steepest decline occurring in the urban core. Annual average concentrations for the entire metropolitan Boston area fell from 41 ug/m^3 in 1971 to 18 ug/m^3 in 1974. At the same time, SO_2 concentrations in downtown Boston declined from 63 ug/m^3 in 1971 to 19 ug/m^3 in 1974.

The dramatic decrease in annual average SO_2 concentrations between 1971 and 1974 was a result of sulfur-in-fuel regulations. Because of the lower SO_2 ambient levels in 1974 and the increased cost of low-sulfur fuel oil, new legislation (Massachusetts General Laws of 1974, Chapter 494) allowed utilities and industries meeting specific stringent conditions (e.g., protection of standards and public health) to burn higher sulfur fuel oil. As a result, ambient SO_2 levels increased slightly between 1975 and 1978 but remained well within all ambient standards.

Since 1978, the overall annual average SO_2 concentrations in metropolitan Boston have consistently remained between 33 and 36 ug/m^3, which is only 40 to 46 percent of the annual standard. However, concentrations did vary significantly from station-to-station. Kenmore Square monitoring station, for example, has consistently recorded annual average concentrations between 50 and 55 ug/m^3, while concentrations recorded at Long Island ranged between 22 and 26 ug/m^3.

Nitrogen Dioxide (NO_2)

A summary of annual NO_2 ambient data from 1981 to 1985 is provided in Table 6.2.4-6. No NO_2 monitoring station in the vicinity of Deer Island recorded a violation of the annual standard of 100 ug/m^3. The entire region is currently designated as "better than national standards"

TABLE 6.2.4-5

AMBIENT AIR QUALITY DATA SUMMARY
FOR SULFUR DIOXIDE

Monitoring Site	Year	3-Hr Running Average Highest (ug/m^3)	3-Hr Running Average 2nd Highest(1) (ug/m^3)	24-Hr Daily Average Highest (ug/m^3)	24-Hr Daily Average 2nd Highest(1) (ug/m^3)	Annual Arithmetic Mean(2) (ug/m^3)
Deer Island	1981	---	---	---	---	---
Boston	1982	179	178	96	60	---
	1983	---	---	---	---	---
	1984	---	---	---	---	---
	1985	---	---	---	---	---
Atlantic Ave.	1981	359	280	191	147	41
Boston	1982	---	---	---	---	---
	1983	---	---	---	---	---
	1984	288	288	168	134	35
	1985	---	---	---	---	---
Long Island	1981	233	196	113	104	23
Boston	1982	---	---	---	---	---
	1983	---	---	---	---	---
	1984	236	210	254	238	19
	1985	---	---	----	---	---
340 Bremen St.	1981	215	204	126	102	37
East Boston	1982	364	281	128	116	37
	1983	---	---	---	---	---
	1984	279	261	171	141	34
	1985	---	---	---	---	---
Power Horn Hill	1981	---	----	---	---	---
Chelsea	1982	---	----	---	---	---
	1983	---	---	---	---	---
	1984	367	263	109	102	24
	1985	---	---	---	---	---

NOTES:

1. Standard compliance is determined by comparing the second highest recorded value to the 3-hour standard of 1300 ug/m^3 and the 24-hour standard of 365 ug/m^3.

2. Annual standard is 80 ug/m^3.

TABLE 6.2.4-6

AMBIENT AIR QUALITY DATA SUMMARY
FOR NITROGEN DIOXIDE

Monitoring Site	Year	1Hr Average Concentration Highest (ug/m^3)	1Hr Average Concentration 2nd Highest (ug/m^3)	Annual Arithmetic Mean[1] (ug/m^3)
Deer Island	1981	---	---	---
Boston	1982	433	395	60
	1983	304	234	30
	1984	---	---	---
	1985	---	---	---
Bremen St East Boston	1981	214	207	55
	1982	303	258	43
	1983	332	286	50
	1984	333	263	61
	1985	---	---	---
Power Horn Hill Chelsea	1981			
	1982			
	1983			
	1984	667	517	42
	1985			

NOTE:

1. Annual standard is 100 ug/m^3.

for NO_2.

In addition to the State and Federal standard for annual average concentrations, Massachusetts DEQE has followed its own policy for short-term NO_2 concentrations applicable to new or modified major sources of oxides of nitrogen (NOx). Specifically, new or modified major sources of NOx that increase emissions to the atmosphere by more than 250 tons per year must demonstrate that the operation of the source will not, with consideration of ambient background, cause or significantly contribute to NO_2 concentrations in excess of 320 ug/m^3 for any 1-hour period on more than 1 day per year.

Highest and second highest 1-hour average NO_2 concentrations are provided in Table 6.2.4-6. Concentrations recorded at Deer Island and Power Horn Hill in Chelsea show some violations of the Massachusetts 1-hour guideline of 320 ug/m^3.

Ambient levels of NO_2 are primarily a result of NOx emissions from motor vehicles and stationary combustion sources. It is estimated that motor vehicle emissions constitute 45 percent of all NOx emissions, while stationary combustion sources contribute 50 percent. Electric utilities are responsible for approximately 56 percent of the NOx emissions from stationary combustion sources (EPA 1979). It follows, then, that approximately 30 percent of all NOx emissions are attributable to electric utilities. Because of their elevated stacks, stationary sources are generally far less significant contributors to ground-level ambient concentrations of NO_2 than motor vehicles.

Determination of trends in NO_2 concentrations from 1971 to 1977 is more difficult to accomplish and conclusions are probably less reliable than for the other criteria pollutants due to the sparsity of the data base and the lack of continuous measurement equipment. However, DEQE is of the opinion that, based on the available non-continuous data, the ambient concentrations at almost all its monitoring stations were in compliance with the annual standard of 100 ug/m^3 for the period from 1971 to 1977 (DEQE 1978). In 1977, when continuous monitoring became more readily available, only those sites located close to heavily traveled roadways (i.e., the NOx source of most concern) were retained. From 1977 to 1981, the more reliable continuous monitoring data have not revealed any discernible trend in annual NO_2 concentrations.

Carbon Monoxide (CO)

Table 6.2.4-7 summarizes CO ambient air quality data from 1981 through 1985. No violation of the primary and secondary 1-hour standard of 40 mg/m^3 was recorded at any station during the 4-year period analyzed. However, violations of the 8-hour standard of 10 mg/m^3 have occurred at the East Boston monitoring sites.

Trend data for CO are available for the period from 1973 to 1981. These data are generally reported in terms of number of violations of the 8-hour standard, and annual average concentrations (although no annual standards exist for CO). Results show a significant and continuous decrease in both the number of 8-hour violations and annual average concentrations in metropolitan Boston throughout the period. This is directly attributable to the replacement of older, less efficient automobiles with newer models equipped with emission control systems.

TABLE 6.2.4-7

AMBIENT AIR QUALITY DATA SUMMARY
FOR CARBON MONOXIDE

Monitoring Site	Year	1Hr Average Highest (mg/m^3)	1Hr Average 2nd Highest(1) (mg/m^3)	8Hr Average Highest (mg/m^3)	8Hr Average 2nd Highest(1) (mg/m^3)
340 Bremen St	1981	12	12	10	8
East Boston	1982	17	17	11	10
	1983	--	--	--	--
	1984	16	14	8	7
	1985	--	--	--	--

NOTE:

1. Standard compliance is determined by comparing the second highest recorded value to the 1-hour standard of 40 mg/m^3 and the 8-hour standard of 10 mg/m^3.

The continuous long-term decrease in CO concentrations is not unexpected since CO emissions are largely caused by automobile exhaust.

Ozone

Two monitoring stations in the general vicinity of Deer Island have collected ozone data during the 5-year period analyzed (1981-1985). One violation of the ambient standard for ozone has occurred during the period. The highest and second highest 1-hour concentrations of ozone are listed in Table 6.2.4-8. The EPA attainment status designation lists the entire area as "nonattainment".

Ozone is a widespread problem, not limited to any one specific area. Ozone moves easily over great distances, and local violations are often the result of such mobility.

Ozone concentrations are in large part due to the emissions of volatile organic compounds (VOC), NOx, and, to a lesser extent, CO generated by transportation-related sources, in particular, the automobile. However, VOC emissions from industrial sources and NOx emissions from utility sources are also believed to contribute to ozone formation. Emissions of these pollutants in the presence of sunlight are believed to trigger photochemical oxidation leading to the production of ozone (EPA 1979). Although the detailed formation processes are not well known, traditional opinion in the scientific community is that ozone is formed in the stratosphere (i.e., above 7.5 miles) and transported to the ground in the vicinity of frontal zones or breaks in the tropopause which separates the stratosphere from the troposphere (Danielson 1977). Hence, local emissions of the precursor pollutants are not thought to significantly contribute to local ozone concentrations, but are instead transported downwind while undergoing the photochemical oxidation process.

The attempt at reducing ozone concentrations in metropolitan Boston and elsewhere is based on a cooperative effort by federal, state, and local agencies in limiting the precursor pollutants with the emphasis placed on the control of automotive exhaust. However, progress achieved to date in reducing ozone concentrations through control strategies is difficult to discern. Analysis of trend data (1973 through 1981), generally reported in terms of number of standard violations per year, shows no clear trend in ambient concentrations of ozone. Annual variations in the number of recorded 1-hour violations appear to be more dependent upon meteorology than any significant change in precursor emissions.

Lead

Unlike the other criteria pollutants for which standards were established during the early 1970's, the ambient standard for lead was promulgated in October 1978. The ambient standard is 1.5 ug/m^3, maximum arithmetic mean concentration averaged over a calendar quarter. In addition to the relatively recent promulgation of the lead standard, ambient air quality monitoring, data reporting, and surveillance provisions for this pollutant have been slow to evolve because of technical uncertainties. Primarily as a result of this, the existing data base for lead is limited to one site in the general vicinity of Deer Island: Chestnut and 6th Street, Chelsea. Ambient monitoring data collected from 1981 to 1985 at this site are

TABLE 6.2.4-8

AMBIENT AIR QUALITY
DATA SUMMARY FOR OZONE

		1Hr Average	
Monitoring Site	Year	Highest (ppm)	2nd Highest(1) (ppm)
340 Bremen St East Boston	1981	0.115	0.095
	1982	0.145	0.117
	1983	0.112	0.110
	1984	0.107	0.073
	1985	---	---
Power Horn Hill Chelsea	1981	---	---
	1982	---	---
	1983	---	---
	1984	0.125	0.125
	1985	---	---

NOTE:

1. Standard compliance is determined by comparing the second highest recorded value to the 1-hour standard of 0.12 ppm.

presented in Table 6.2.4-9. No violations of the standard have been recorded at this monitoring site. Lead ambient standard attainment designations have not yet been promulgated for Massachusetts.

Lead is emitted to the atmosphere by vehicles burning leaded fuel and by certain stationary sources which include lead smelters, gasoline lead additive manufacturers, and lead storage battery manufacturers.

6.2.5 LAND USE AND VISUAL CHARACTER

Land Use

Deer Island, connected to the southern tip of Winthrop, is 203 acres in size. The two active land uses are the Deer Island House of Correction, owned and operated by the City of Boston, and the MWRA's existing 343 mgd primary treatment facility for the North Service area. Combined, these facilities occupy a total of approximately 60 acres toward the landward side of the island. Except for the treatment plant and prison structures, almost all of Deer Island is open space with recreational use limited to prison recreation areas and passive recreational areas used by prison and treatment plant employees. Occasional visitors use the south end of the island for passive recreation.

Deer Island is zoned "B-1, General Business" by the City of Boston. This classification allows all commercial and residential uses, but excludes industrial or other nonconforming uses without a variance. The existing nonconforming uses of the prison and the treatment plant predate the zoning classification.

The Deer Island House of Correction has over 450 inmates, with over 4,000 visitors annually. House-to-house searches undertaken in the neighborhood and the use of sirens following prison escapes (20 during 1983) have aggravated neighborhood residents. Past concerns for the prison's problems and proximity to residential areas have led to local, state and federal efforts to relocate this facility. Applicable state law requires that the House of Correction be relocated by 1989.

Although a prison and a sewage pumping station have been located on Deer Island for nearly 100 years, it was after the hurricane in 1936 that these metropolitan uses on Deer Island began to be more closely associated with the Point Shirley neighborhood. Prior to this time, Shirley Gut and its swiftly moving currents physically separated Deer Island from Winthrop. Access was by ferry. Hurricane winds and tides deposited sand and silt that connected the Island to Winthrop. This was consolidated and made into a causeway permanently linking the two areas. Loss of the Gut reduced the flushing action around Deer Island and brought the island into closer association with the Town of Winthrop (even though Deer Island remained a part of the City of Boston).

The Point Shirley and Cottage Hill neighborhoods are the closest communities to Deer Island. They are situated on a narrow peninsula with Point Shirley connected to Deer Island and separated from Winthrop by a causeway. The neighborhoods are predominantly residential with

TABLE 6.2.4-9

AMBIENT AIR QUALITY
DATA SUMMARY FOR LEAD[1]

Monitoring Site	Year	Quarter	Quarterly Arithmetic Mean[2] (ug/m^3)
Chestnut and 6th Chelsea	1981	Second	---
		Fourth	---
	1982	First	0.54
		Second	0.33
		Third	0.46
		Fourth	0.42
	1983	First	0.26
		Second	0.23
		Third	0.37
		Fourth	0.40
	1984	First	0.27
		Second	0.26
		Third	0.27
		Fourth	0.34
	1985	---	---

NOTES:

1. Federally compiled data, EPA/atmospheric surveillance.

2. Standard compliance is determined by comparing the recorded quarterly arithmetic mean to 1.5 ug/m^3.

approximately 450 residences and a population of about 1000 people in Point Shirley, and about 1400 residences and approximately 3400 people in Cottage Hill. A majority of the homes, originally built as summer cottages, have been winterized and are used on a year-round basis. Most major commercial activity in Winthrop is located along the main truck route to Deer Island. Zoning in Point Shirley, Cottage Hill and throughout much of Winthrop is "Residence A, Single Family Use."

The construction of a sewage treatment plant by the MDC in the 1960's was initially perceived as a positive development in the neighborhoods. Over time, the increasing lack of funds for maintenance has resulted in a gradual deterioration of this facility.

Areas surrounding Deer Island can be characterized as residential in Winthrop to the northwest, transportation oriented at Logan International Airport to the west, open/institutional on Long Island and the President Roads shipping channel to the south, and open water (Broad Sound and the Atlantic Ocean) to the north and east.

Traffic

Land access to Deer Island is available by only two routes as shown in Figure 6.2.5-1. The major access route is via Saratoga Street in East Boston. This becomes Main Street in Winthrop at the bridge crossing Belle Isle Inlet. An alternative route is through Revere via Winthrop and Shore Drive. Both roadways are part of Route 145. However, only the Winthrop route is open to trucks along its entire length (designated as the truck route to Deer Island). Along the designated truck route, there is a 33 ton load limit for the bridge on Saratoga Street.

The traffic capacity of the predominantly two-lane local urban streets in the vicinity of Deer Island is approximately 1600 vehicles per hour (total for both directions). Present traffic flows on local roads are in the range of 150 to 625 vehicles per hour (total for both directions). Traffic volume data for 1984 and 1985 are shown in Table 6.2.5-1. While local roads have more than adequate excess capacity to accommodate additional construction traffic, there is often congestion at certain intersections during the morning and evening rush hours. Calculations performed in the Final Environmental Impact Report, based on U.S. Department of Transportation Level of Service Criteria, indicate that long delays can be expected during the evening peak hour traffic at several intersections along the access routes to Deer Island.

Visual Character

With an elevation at the summit of 210 ft., the drumlin is the dominant natural feature on Deer Island. Although it has been altered by activities related to the treatment plant and the military, it is still a prominent visual feature. defining and characterizing Deer Island from locations on-shore and in the Harbor.

A visual analysis of the Island was performed by Jung-Brannen Assoc. in 1986 as part of this study. It identified six visual zones within Boston Harbor -- the inner harbor, Dorchester

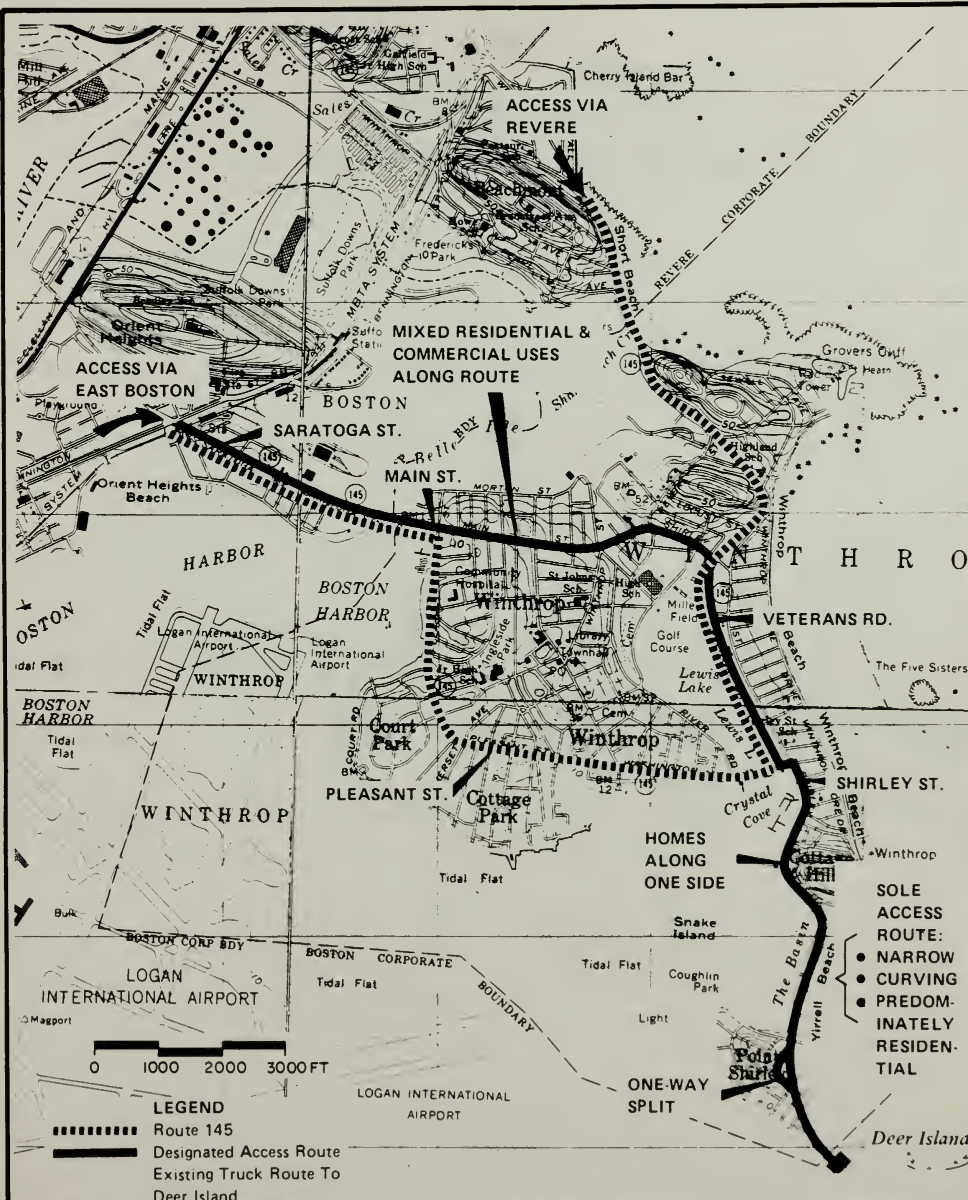


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FIGURE 6.2.5-1
ACCESS ROADWAYS TO DEER ISLAND

TABLE 6.2.5-1

WINTHROP TRAFFIC FLOW DATA, 1984 AND 1985

1984 Data (EPA 1984)

Location	2-Way ADT	2-Way DHV	2-Way AM Peak Hr.	2-Way PM Peak Hr.
Washington St.	7,700	625		
Veterans Rd.	2,700	225		
Shirley St.				
S. of Washington	6,700	525		
N. of Washington	1,900	150		
Revere & Cross	4,700	370	260	358
Pontos & Petrel	5,300	420	272	343

1985 Data (MWRA 1985)

Location	One-Way ADT		One-Way AM Peak		One-Way PM Peak	
	NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB
Main St.	6,668	6,349	365	577	614	405
Veterans Rd.	1,194	1,715	81	97	96	146
Shirley St.						
S. of Washington					285	324

Bay, Quincy Bay, Hingham Bay and two clusters of islands: Gallop, Lovells, George's Island and the Brewsters (Jung-Brannen, 1986). Two major gateways and three minor gateways to the Harbor were evident. Deer Island and Long Island frame the major Atlantic gateway to the outer harbor, while Logan International Airport and Castle Island frame the second major gateway between the inner and outer harbor. Nut and Peddock Islands create a minor gateway between Quincy Bay and Hingham Bay. The other two minor gateways do not impact the MWRA project area.

Based upon the identification of landmarks, zones of vision were drawn from the near and distant viewpoint landmarks. It was determined that near views to Deer Island were available from various places in Winthrop, Logan Airport, Castle Island, and the islands to the south. Distant views are available from the office towers of downtown Boston and Back Bay, the JFK Library in Dorchester, from the shores of Nahant, and from the point at Hull High School. From the water, three types of craft have views of the site: commercial ships in the main channels; passenger ferries that follow designated routes; and recreational craft that can view the site from several points.

6.2.6 NOISE

Noise associated with the construction and operation of the new Deer Island secondary wastewater treatment plant has the potential for impacting portions of the Town of Winthrop. To minimize noise impact, noise control requirements will be incorporated into the treatment plant facilities planning process through the use of noise evaluation criteria. These criteria will be employed to judge the effectiveness and acceptability of noise controlling alternatives as they apply to wastewater treatment equipment, site planning, and construction. The existing regulatory and environmental factors that constitute the basis for developing the noise evaluation criteria are summarized in this section.

Regulatory criteria that address noise control, as well as assessments of potential impacts, rely on evaluations of baseline noise levels for judging the magnitude and acceptability of incremental noise changes. Several baseline noise surveys have previously been made within the Point Shirley study area. These surveys sampled ambient noise for periods of a few minutes up to 24 hours.

This section characterizes existing noise within the study area, and describes a more extensive study that was conducted during this facilities plan to provide a firm statistical basis for the development of recommended noise criteria for Deer Island. The results of this survey, and recommendations for construction and operational noise criteria, are summarized herein.

Regulations and Guidelines

The assessment of noise impact involves determining both the increase in ambient noise and compliance with appropriate regulations. Three noise regulations are potentially applicable to the site. These are the City of Boston Noise Regulations, the Massachusetts Department of Environmental Quality Engineeering (DEQE) guidelines, and U.S. Department of Labor's Occupational Safety and Health Administration (OSHA) standards.

The City of Boston's noise regulations address various sources of noise and set specific noise limits for the transmission of sound between properties of the same and different zoning. The allowable noise transmitted to a residential zone during the daytime hours of 0700 to 1800 (7:00 a.m. to 6:00 p.m.) is 60 dBA. A 50 dBA level is allowable during the remaining nighttime hours. The maximum allowable noise allowed to be transmitted to an industrial site is 70 dBA. The code also has corresponding octave band level requirements.

The Boston noise code limits construction noise at the residential and institutional property lines to an L10 (the level exceeded 10 percent of the time) of 75 dBA and a maximum level of 86 dBA. The allowable L10 for recreational land is 80 dBA. Construction is not permitted at night or on weekends unless the construction noise level at the residential property line does not exceed 50 dBA.

The State of Massachusetts Department of Environmental Quality Engineering (DEQE) guidelines on noise allow a new facility to increase the ambient noise a maximum of 10 dBA over the existing L90 ambient noise, i.e. the level exceeded 90 percent of the time. The L90 levels to be used are the lowest values measured at night. The DEQE guidelines also prohibit the emission of a pure tone from noise sources. A pure tone is defined as occurring when the level in one octave band exceeds the level in the two adjacent octave bands by 3 dB or more.

All equipment on the site will be required to conform to the OSHA requirements on noise exposure. These regulations allow an equivalent 8-hour exposure of 90 dBA for the protection of employee hearing. Where equipment cannot be purchased to meet OSHA noise exposure requirements, noise mitigation must be added as required.

Previous Ambient Sound Level Surveys

At least five previous ambient sound level surveys associated with the Deer Island treatment facilities have been conducted in the Deer Island area. These surveys are summarized in Table 6.2.6-1. The surveys collected statistical sound level samples of a few minutes to an hour in duration, and in one instance, 24 hours. Measurements were usually collected at several locations. These measurements were used for making preliminary assessments of anticipated noise impact for the facility.

However, as part of secondary treatment facility planning and environmental reviews, a more extensive data base was desired. Ambient noise is a statistical quantity which not only varies diurnally, but also from day to day. Both the perceived noise impact and the allowable level as required by the DEQE are based on an assessment of the existing ambient sound level. A sampling program which continuously monitored ambient sound levels 24 hours a day for a total of 17 days was conducted. This large sample of ambient sound levels provides a broad base for assessing the existing ambient levels.

TABLE 6.2.6-1

SUMMARY OF PREVIOUS AMBIENT SOUND LEVEL SURVEYS CONDUCTED IN WINTHROP FOR THE WASTEWATER TREATMENT PLANT

CONDUCTED BY	DATE	REPORTED IN
Metcalf and Eddy	1982	Site Options Study, Vol. II 1982.
Havens and Emerson	4-3-84	Supplemental Draft Environmental Impact Statement/Report on Siting of Wastewater Treatment Facilities for Boston Harbor. Vol. 2.
Thibault and Bubly Associates	6-12-85	Noise Analysis (To EPA).
Cavanaugh Tocci Associates	9-11-85 9-25-85	Supplemental Draft Enviornmental Impact Statement/Report on Siting of Wastewater Treatment Facilities for Boston Harbor. Vol. 2, Appendix.
C.E. Maguire, Inc.	7-1-86	Notice of Project Change, On-Island Water Transportation Facilities, 7-31-86.

Ambient Sound Level Survey

For this study, an ambient sound level survey was conducted at Point Shirley, in the Town of Winthrop, as the nearest area potentially impacted by facility construction and operation noise. The goals of the survey were to:

1) Establish the spatial variation in the ambient sound levels throughout Point Shirley.

2) Establish the diurnal variation in the sound levels.

3) Determine the temporal variability of sound levels from day to day.

4) Identify the sources of noise controlling these levels.

Measurement Locations and Methodologies

A preliminary inspection of the study area indicated that the primary noise sources were Logan Airport, traffic on Tafts Street and other local roads, surf noise from the beaches, and occasionally the existing treatment plant. Previous studies also indicated that the Nordberg diesel drives on the existing wastewater pumps were sometimes audible. These previous studies also assessed the sound levels throughout Winthrop and concluded that the mainland portion of Winthrop had nighttime L90 levels in the 34 to 40 dBA range, whereas Point Shirley was slightly louder, in the 40-43 dBA range. Since the distance to the other parts of Winthrop are greater, the criteria selected for Point Shirley will also serve as conservative criteria for the balance of Winthrop.

Measurement locations were selected to provide data on each of the sources discussed in the previous paragraph, as well as to be spatially distributed across Point Shirley. A map of the locations is given in Figure 6.2.6-1. All of the locations except No. 1 have line-of-sight shielding by houses from the airport and surf. Location 1 was shielded by a house from the diesel pump station. Locations 2 and 3 had line-of-sight visibility to the diesel pump station.

Two types of noise survey methodologies were utilized which, when used in conjunction with each other, provide a complete description of the spatial and temporal variation in sound levels. The first type consisted of the continuous statistical monitoring of sound level sequentially at locations 1 and 3, shown in Figure 6.2.6-1. A total of 17 data days were taken sequentially at these locations. Locations close to the plant were selected for the continuous monitors because the potential for noise impact is the greatest close to the site. The monitor was periodically calibrated throughout the survey.

The second type of survey was staffed, and measurements were taken with portable instrumentation. During these surveys, 10-minute statistical samples of sound level data were always taken, and on three out of five of the surveys, residual octave band measurements were also taken. The staffed surveys enable a number of locations to be measured in a relatively brief period of time along with observations of the sources of noise. The staffed surveys were

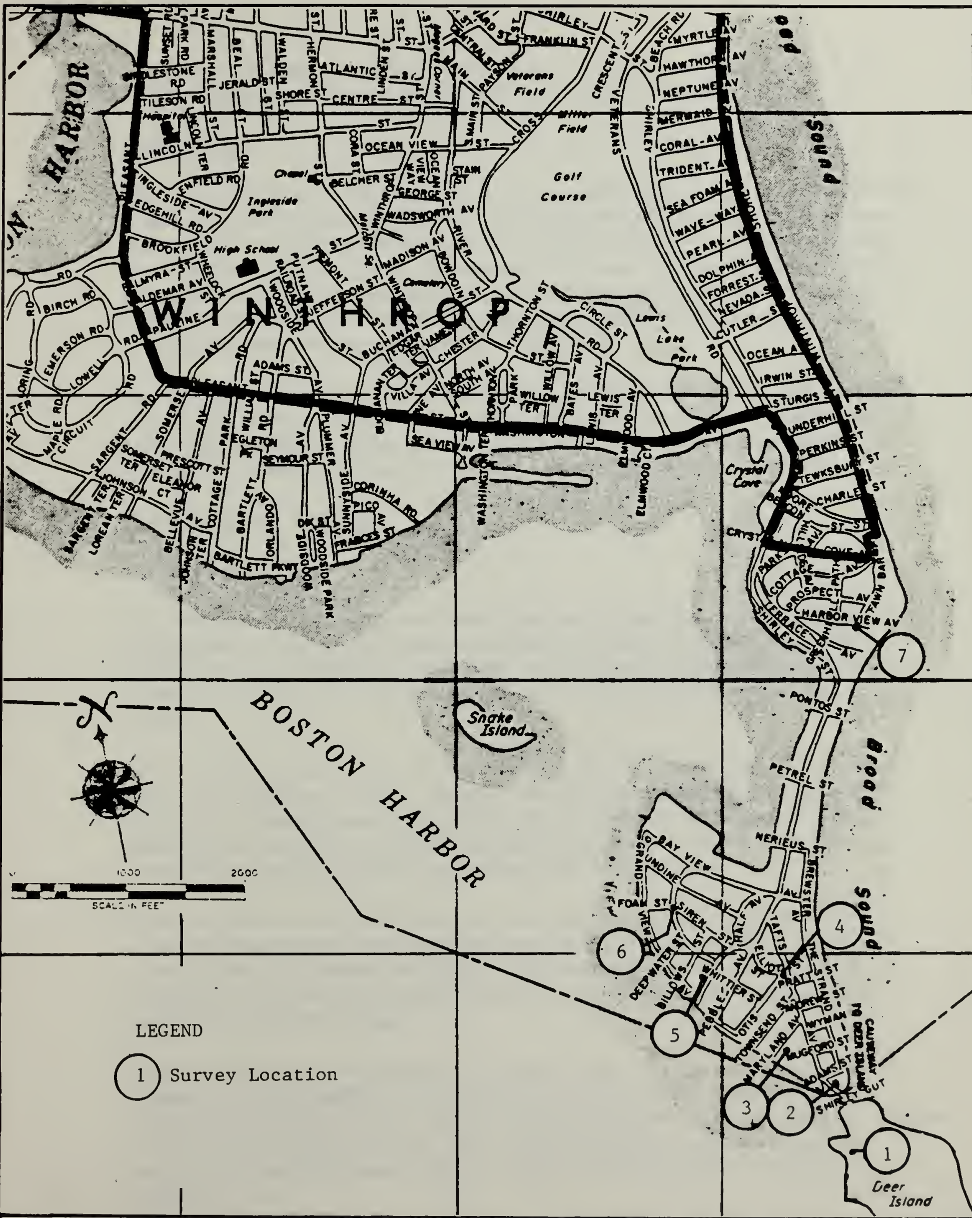

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FIGURE 6.2.6-1
AMBIENT SOUND LEVEL SURVEY
MEASUREMENT POSITIONS, WINTHROP, MASSACHUSETTS, SEPTEMBER 1986

conducted during 2- to 3-hour periods during the day and night at locations 1, 2, 4, 5, 6, and 7. The staffed survey results are given in Appendix C, Tables C-1 through C-5.

Instrumentation

Two types of instruments were used for measuring the ambient sound levels. A Larson-Davis 800 Noise Analyzer and a Bruel and Kjaer 2215 sound level meter were used manually to measure residual octave band sound pressure levels and A-weighted sound level statistics. The residual octave band measurements are taken in the absence of transient noise such as passing vehicles and aircraft landings. Ten-minute statistical samples of the A-Weighted sound level were taken by reading the meter every 10 seconds and preparing a histogram of the data. All manual measurements were taken with local winds less than 10 mph.

The second type of instrument used was a Larson-Davis 700 Noise Dosimeter, which continually measures and statistically analyses the variable ambient noise. The device was programmed to provide hourly statistics including the L10, L50 and L90 values. The L90 value typically represents the residual or background level which occurs when transient noise is absent.

Survey Results and Discussion

Manually Collected Data

The manually-collected data discussed above is presented in Appendix C, Tables C-1 through C-5. Most of the L90 sound level data taken some distance from the water (locations 4, 5, and 6) were determined to be in the 42-47 dBA range. Measurements taken from locations that are more exposed to surf noise, such as locations 1, 2, 3, and 7, were sometimes several decibels higher.

During the day and evening, the quiet intervals between aircraft takeoff and landing noise were observed to be infrequent and brief. However, after the hours of approximately 2300 to 2400 (11:00 p.m. to midnight), takeoffs and landings became infrequent and the residual levels appeared to be controlled by surface aircraft operations at Logan Airport, surf noise, and occasionally the Nordberg diesels of the treatment plant wastewater pumps.

In general, the more sheltered locations, i.e. those away from the shore, were 5 or 6 dBA quieter than those near the water because they were partially shielded from Logan ground operations, surf, and occasional diesel noise. This was directly observed in the field by measuring noise primarily from surface aircraft operations, and then moving behind a house to block the line of sight to the airport.

The pump station diesels were inaudible at all locations when the winds were northerly. This is because the vertical gradient in wind speed tends to raise the upwind sound wave off the ground and creates a shadow zone. However, when the winds had a southerly component, i.e. from the direction of the diesels, the diesels were occasionally audible at one or two measurement locations which varied from survey to survey. Diesel audibility is indicated in Appendix C, Tables C-1 to C-5.

When audible, the diesel sound varied in an irregular, pulsing manner caused by multiple diesel units operating at slightly different speeds. Most of the diesel noise was in the 63 Hz octave band corresponding to the cylinder firing rate. At one of the measurement locations the diesels caused a 4 dBA variation in the sound level on "fast" response. The level in the 63 Hz band on "fast" response varied from 5-10 dB. On "fast" response the meter's response time is reduced and the meter becomes very sensitive to rapid changes in sound level. All other measurements were taken on "slow" response as is standard practice for community noise measurements.

Continuous Monitor Data

A tabulation of the data from the continuous monitor used first at Location 1 and then at Location 3 is given in Appendix D. This data describes the diurnal variation in sound level for 13 days at Location 1, and 5 days at Location 3. The data from the two locations are very similar and are analyzed together.

The L90 data were divided into meaningful time periods and sorted to examine the group statistics. The L90 sound levels for the nighttime period of 2300 to 0600 (11:00 p.m. to 6:00 a.m.) were grouped together and sorted to determine their percentiles of exceedence. During this period of time, it is likely that a significant percentage of the population would be sleeping.

This analysis indicates that, during 50 percent of the time, the nighttime L90 values were greater than 45 dBA, indicating that 45 dBA is a typical value for the nighttime L90 sound level. The 90 percentile value of the L90 sound level at that location exceeds 39 dB. The lowest hourly L90 measured was 35 dBA at location 1.

A similar analysis was performed for the daytime hours of 0700 to 1800 (9:00 a.m. to 6:00 p.m.). This time period includes the most common periods of construction. The quietest hour during this period was at 41 dBA. However, 90 percent of the time the L90 levels were in excess of 45 dBA, and 50 percent of the time they exceeded 51 dBA. These measurements generally agree with the previous shorter-term assessments on noise on Point Shirley.

Recommended Criteria

Two noise assessment criteria are required: one for assessing the noise from daytime activities such as construction and operation of the facility; and one for assessing the nighttime operation of the facility. These criteria differ because the ambient sound level changes from day to night.

The nighttime L90 sound level is generally used to assess nighttime noise impact. However, when a large sample of L90 data is collected, it becomes necessary to statistically select a representative L90 value. In order to be conservative, the 90 percentile value of the nighttime L90 values was selected for assessing nighttime noise impact. In other words, 90 percent of the nighttime L90 values exceed this value.

It is recommended that 39 dBA be used to assess the maximum nighttime noise impact at the property line. Other portions of Winthrop are much further in distance from Deer Island, and will receive adequate protection with this same criterion. This would also result in a DEQE requirement of 49 dBA for the allowable 10 dBA above ambient stipulated in Massachusetts DEQE Regulation 10 of the Air Pollution Regulations. It is not suggested that a 49 dBA level is the design goal, but rather that this level is a legal requirement that the site must, and will, meet as a maximum.

In a similar manner, the criterion for assessing daytime noise impact was determined to be 45 dBA. Since the lowest ambient noise levels occur during the middle of the day and the middle of the night, the maximum impact assessment criteria remain essentially the same during the evening as during the day.

In summary, the ambient sound levels (L90) for assessing maximum nighttime and daytime noise impact in the Point Shirley area are 39 and 45 dBA, respectively, as shown in Table 6.2.6-2. Predicted construction and operation noise will be compared with these levels in future analyses to determine the need for noise mitigation. The DEQE level not to be exceeded for constant nighttime operation noise is 49 dBA.

6.2.7 TERRESTRIAL AND AQUATIC ECOLOGY

Deer Island

Descriptive information for Deer Island was derived from a review of literature pertaining to the Island and from site visits. Literature reviewed is listed in the references and as specific credits given in the text. Site visits were made by Stone & Webster ecologists in 1976 and again in 1986.

Site Conditions

Deer Island is a large island of about 210 acres, dominated by a large grass covered drumlin over 100 feet high (Figure 6.2.7-1). This drumlin, like many of the islands in the harbor, is a geological formation resulting from the accumulation of till, clay and other materials flushed from beneath the ice sheets of 10,000 years ago. Prior to European settlement, the island probably had a community of deciduous forest, with stands of pines also common (Metcalf & Eddy 1982). Because of the relatively isolated nature of the island site, and its exposure to wind and sea salt, any change in the nature of the ecosystem takes a long time to repair itself. Thus, the historical land uses of the site have drastically altered the native vegetation. The present conditions tend to favor communities which form as a fire subclimax (Metcalf & Eddy 1982). These conditions include:

- Topography that favors rapid drying
- Regeneration from undamaged underground plant parts
- Porous soil
- Seeds enclosed within fire resistant woody fruits.

TABLE 6.2.6-2

SUMMARY OF RESIDUAL SOUND LEVELS,
POINT SHIRLEY, TOWN OF WINTHROP

	L90
Daytime 0700-1800 (7:00 a.m. - 6:00 p.m.)	45 dBA
Nighttime 2300-0600 (11:00 p.m. - 6:00 a.m.)	39 dBA

	Criteria
DEQE nighttime operation noise limit, no pure tone	49 dBA
DEQE daytime operation noise limit, no pure tone	55 dBA
OSHA on-site 8 hour exposure limit	90 dBA

Flora

A majority of the present day site is either used for urban (commercial/institutional) activities or is covered with a scrub growth of coarse grasses and brush (Figure 6.2.7-1). The northwest portions of the island are primarily occupied by the existing waste treatment plant and are vegetated, if at all, by scattered grasses and forbs.

Scrub areas along the western side of the island to the south of the sewage treatment plant are primarily old fields dominated by ragweed (Ambrosia artemisifolia). In the low, damp areas, ragweed exceeds 1.5 meters in height. Wild carrot (Daucus carota), chicory (Cichorium intybus), and goldenrod (Solidago spp.) are also abundant. Along the concrete wall, field bindweed (Convolvulus arvensis), common tansy (Tanacetum vulgare), dwarf cinquefoil (Potentilla canadensis), snowy campion (Silene nivea) and bittersweet (Solanum dulcamara) are common.

North-northwest of the old pumping station, the slope rises steeply. The growth in this area is approximately one meter high and dominated by grasses. Ragweed, wild carrot and milkweed were found at the base of the slope. The walkways around'''' the buildings of the pump station were overgrown with numerous other forbs.

The slope above the pumping station is an abandoned orchard, dominated by apple (Pyrus sp.), black cherry (Prunus serotina) and staghorn sumac (Rhus typhina). On the central and southern sections of the island is an old field dominated by unidentified grass species (Gramineae). Rabbit's-foot clover (Trifolium arvense), daisy fleabane (Erigeron sp.), common burdock (Arctium minus), milkweed (Asclepias sp.) and bouncing bet (Saponaria officinalis) were also present. This area also contains scattered clumps of trees of diverse mixtures including black cherry, Indian bean (Catulpa sp.), quaking aspen (Populus tremuloides), cottonwood (Populus deltoides), sugar maple (Acer sacchrum) and others.

To the east of the Fort Dawes concrete wall, the island is primarily grassland. The area contains scattered shrubs such as bayberry (Myrica pensylvanica), in occasional clumps with giant reed (Phragmites sp.) in the low areas.

Fauna

The varied nature of the site presents an equally varied habitat for wildlife species. On the west slope of the drumlin, the old field vegetation and the clumps of pioneer tree species all present sufficient cover and forage for numerous bird and mammal species.

Mammals - Reconnaissance of the island revealed that a number of mammals frequent the area. Cottontail rabbits (Sylvilagus sp.) and striped skunk (Mephitis mephitis) have been observed on the island (Table 6.2.7-1). Raccoons (Procyon lotor) and numerous rodents have

Table 6.2.7-1

LIST OF FLORA AND FAUNA OBSERVED AT DEER ISLAND

WOOD SCRUB

Type	Scientific Name	Common Name	Occurrence*
Trees	Pyrus sp.	Apple	Abundant
	Prunus serotina	Black cherry	Abundant
	Prunus sp.	Cherry	Common
	Catalpa sp.	Indian bean	Infrequent
	Rhus typhina	Staghorn sumac	Common
	Rhus glabra	Smooth sumac	Common
	Populus tremuloides	Quaking aspen	Infrequent
	Populus grandidentata	Bigtoothed aspen	Infrequent
	Populus deltoides	Cottonwood	Infrequent
	Acer sacchrum	Sugar maple	Infrequent
	Acer rubrum	Red maple	Infrequent
	Crataegus sp.	Hawthorn **	Infrequent
Shrubs and Vines	Rubus canadenisi	Blackberry	Common
	Vitis sp.	Grape	Infrequent
	Asparagus sp.	Asparagus	Infrequent
	Rose sp.	Rose	Infrequent
	Myrica pensylvanica	Bayberry **	Infrequent
	Spiraea sp.	Spirea	Common

OPEN FIELD

Type	Scientific Name	Common Name	Occurrence*
Forbs	Daucus carota	Wild carrot	Abundant
	Ambrosia artemisiifolia	Common Ragweed	Abundant
	Solanum dulcamar	Deadly nightshade	Common
	Datuar strumonium	Jimson weed	Infrequent
	Solidago spp.	Goldenrod	Common

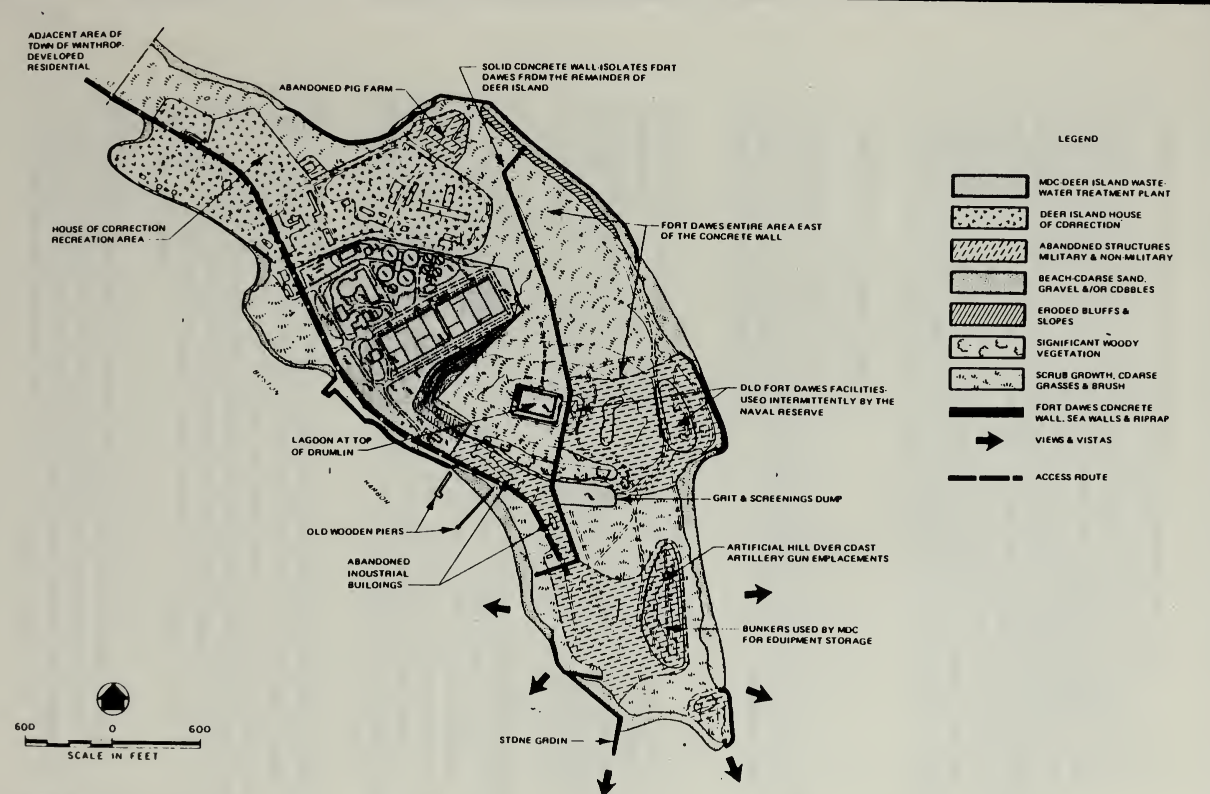
Note: * Abundant - Frequently found, wide distribution
Common - Often found, scattered distribution
Infrequent - Seldom found, scattered distribution

** Old Field Vegetation

	Cichorium intybus	Chicory	Common
	Tanacetum vulgare	Common tansy	Common
	Trifolium arvense	Rabbit's foot clover	Infrequent
	Potentilla canadensis	Dwarf cinquefoil	Infrequent
	Asclepias sp.	Common milkweed	Common
	Gramineae	Grasses	Common-Abundant
	Convolvulus arvensis	Field bindweed	Common
	Saponaria officinalis	Bouncing bet	Common
	Silene nivea	Snowy campion	Common
	Arctium minus	Common burdock	Infrequent
	Erigeron sp.	Daisy fleabane	Infrequent
	Petunia sp.	Petunia	Infrequent
	Solanum sp.	Tomato	Infrequent
	Linaria vulgaris	Butter and eggs	Common
	Phragmites sp.	Giant reed	Common

FAUNA

Mammals	Sylvilagus spp.	Cottontail rabbit	Common
	Mephitis mephitis	Striped skunk	Common
	Procyon lotor	Raccoon	Infrequent
	Rodentia	Mice and voles	Common-Abundant
Birds	Agelaius phoeniceus	Red-winged black bird	Abundant
	Cyanocitta cristata	Bluejay	Common
	Corvus brachyrhynchos	Crow	Common
	Larus argentatus	Herring gull	Abundant
	Larus marinus	Great black-backed gull	Common
	Hirundinidae	Swallow	Abundant
	Charadrius sp.	Plover	Common
	Pasianus colchicius	Ring-necked pheasant	Common
	Falco sparverius	Sparrow hawk	Common



SOURCE: Metcalf & Eddy, June 1982

MASSACHUSETTS WATER RESOURCES AUTHORITY

FIGURE 6.2.7-1
DEER ISLAND EXISTING CONDITIONS

been found on the island (Boston Harbor Comprehensive Plan 1972).

Birds - A number of bird species have been observed on the island (Table 6.2.7-1). Pheasant (Pasianus colchicus), red-winged black bird (Agelaius phoeniceus), bluejay (Cyanocitta cristata), plovers (Charadriidae), herring gulls (Larus argentatus), great black-backed gulls (L. marinus), swallows (Hirundinidae), and crows (Corvus brachyrhynchos) were observed on the island. Of particular note was the sighting of three sparrow hawks (Falco sparverius) hunting over the island. The presence of three raptors in the area suggests the presence of ample game in the form of insects and rodents (S&W Mgt. Cons. 1976). Reptiles and Amphibians - Few or no amphibian or reptile species are expected to inhabit the island because of lack of suitable habitat.

Endangered and Threatened Species

No endangered or threatened species are known to inhabit Deer Island. The US Department of Interior (USDI) list of species protected under the Endangered Species Act of 1973, as amended, contains only four species of terrestrial vertebrates whose geographic range includes Massachusetts (USDI 1986).

Mammals - The Indiana bat (Myotis sodalis) has been recorded in a single locality in Massachusetts (Chancy 1976). Although no individuals have been found in many years, it may still occur in the emery mines in Hampden County, Massachusetts. The mines have been given to the Massachusetts Division of Fisheries and Wildlife in an effort to protect remnants of the bat's population. It is unlikely that this species would be found on Deer Island.

Birds - The Bald Eagle (Haliaeetus leucocephalus) and peregrine falcon (Falco peregrins tundris and F. p. anatum) are all listed as endangered. The bald eagle is characteristically a bird of seacoasts, large remote lakes and river shores. Today, no known breeding populations are found in the state. However, a hacking program by state and federal wildlife agencies (28 eaglets in five years at the Quabbin Reservoir) has reintroduced the bird to Massachusetts (Dyer 1987). The program is scheduled to continue for another three years.

The 1987 winter bird survey found 42 eagles (possibly including a few golden eagles) in the Quabbin Reservoir area and 54 eagles state wide (Dyer 1987). So far none has nested in the area but sexual maturation takes five years and nesting may occur in the next few years. Although it is highly unlikely that bald eagles will ever nest in the harbor islands, even with an increase in their numbers, because of the levels of human activity (Dyer 1987), there is now the possibility of eagles visiting the area while migrating to other parts of New England.

Native breeding populations of the peregrine falcon have been completely extirpated throughout the eastern US, and the arctic peregrine now occurs in the region as a spring and fall migrant. However, the American peregrine falcon has also been successfully reintroduced along the east coast and in particular in Boston (Horwitz 1986). It is the

only species listed by the Federal government as endangered which is likely to be found near Deer Island. A pair of peregrines, a three year old Boston male and a three year old Canadian female, have taken up residence on the McCormick Courthouse Building in Post Office Square and have successfully nested (French 1987a). This is the first successful nest in Massachusetts in 36 years (French 1987b). These birds hunt primarily in the Boston Harbor Islands and thus have a high likelihood of visiting Deer Island.
Of the vertebrates listed in Massachusetts as "threatened" (Ritzer and Franzen 1975), only one species, the Ipswich sparrow (Passercules princeps), could occur in the area of the harbor islands. The sparrow, classified as a subspecies of the Savannah Sparrow, breeds only on Sable Island off the southern coast of Nova Scotia. It winters along beaches, sand dunes and coastal marshes from Massachusetts to Georgia.

Sensitive Communities

The Massachusetts Natural Heritage Program (Michaud 1987) has no record of any rare plant or animal species or unusual plant communities on Deer Island. National Wetlands Inventory maps show no freshwater wetlands on Deer Island, other than the wastewater treatment plant reservoir at the top of the drumlin (USDI 1987). No wetlands qualifying under M.G.L. Chapter 131, S40 were found during the site visits.

Environmental Stress

Major environmental stress which can alter growth and development of biota includes plant diseases, insect pests, pesticides, fire, drought, winds, ice and snow, agriculture activities, air pollution, recreational activities and, occasionally, vandalism. Deer Island has served as a site for a variety of municipal facilities dating back to colonial times. It was the site of an internment camp for hostile Indians, a reformatory, and a quarantine hospital, and it has served as the outlet for the metropolitan area's sewage since the late 1860's. It also was the site of a cemetery and burial areas.

A majority of Deer Island has been subjected to extensive modifications and disturbance, particularly within the last 100 years. The most extensive have included the construction of concrete bunkers, radar and radio facilities and access roads. Related grading of slopes associated with Fort Dawes (1941) disturbed a substantial amount of the drumlin and land areas to the south. The subsequent construction and modifications of the Deer Island Treatment Plant (1968) added to this disturbance over the central part of the island. The prison and prior uses in the northern part of the site had previously disturbed the area to the north and northwest of the drumlin. The treatment plant reservoir at the top of the drumlin is operated by the MWRA.

Because of the extensive land modification caused by more than 100 years of periodic construction activity on Deer Island, very little area on the island has been untouched. As a result, there are no pristine or mature habitats on the island or on its shores and vegetation present on the island consists mainly of weedy invasion species.

Section 6.2.7 References

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6.3 HISTORICAL AND ARCHAEOLOGICAL RESOURCES

Deer Island's historical and archeological resources date from the period from the 1840s to about 1930. They consist of a cemetery and mausoleum, the Deer Island House of Correction, and the Deer Island Pumping Station. Public Archeology Laboratory, Inc. (PAL) conducted the archeological surveys in 1985 to 1987, and Boston Affiliates, Inc. performed the historical survey in the same period.

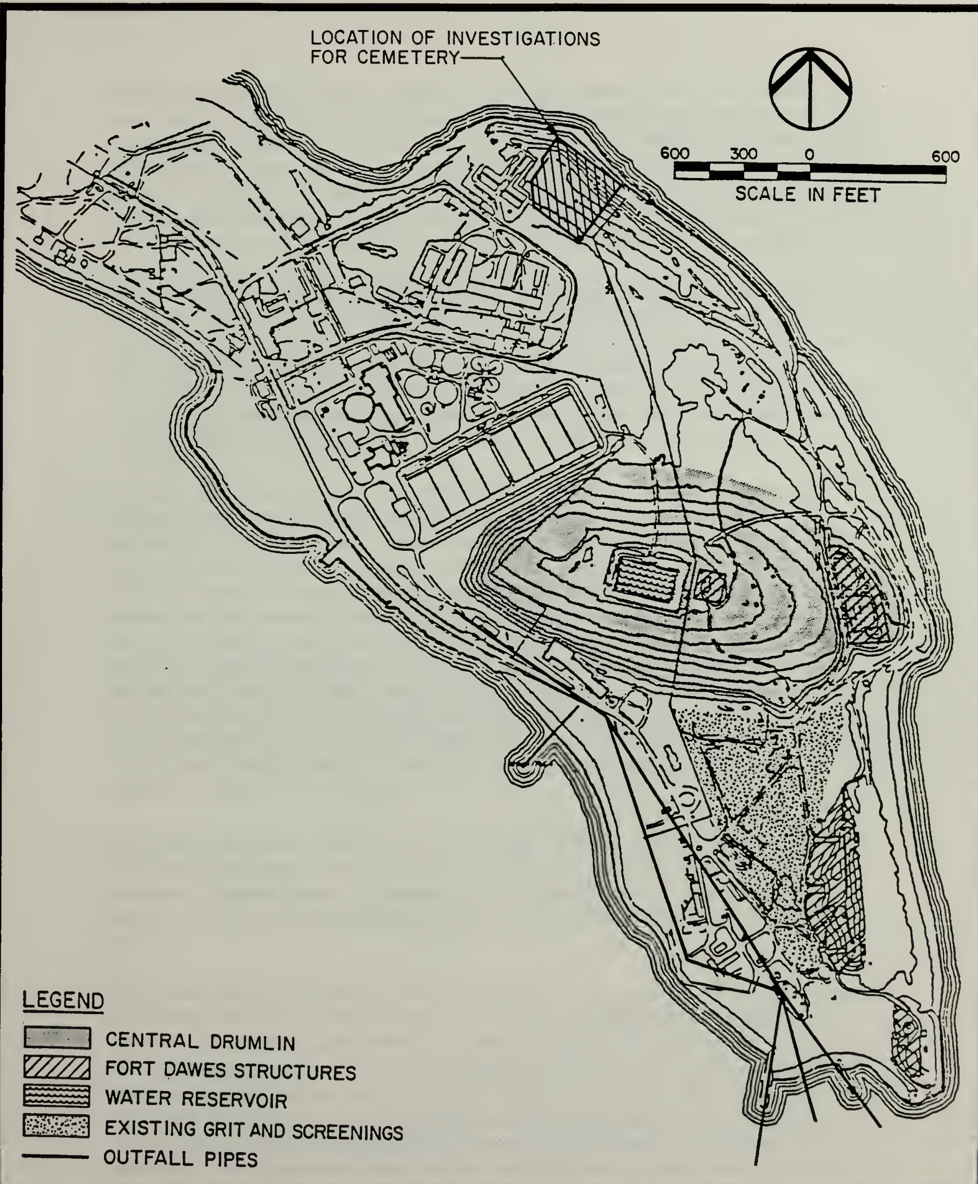
6.3.1 CEMETERY AND MAUSOLEUM

As part of the siting process for this project, a reconnaissance level archaeological survey was conducted by Public Archaeology Laboratory, Inc. (PAL) in September 1985 to identify and document cultural and archaeological resources as well as to assess the extent of previous disturbance within the designated project area.

In the course of the archaeological reconnaissance survey, an historic period cemetery and mausoleum were identified on Deer Island. (Figure 6.3.1-1). The cemetery plot and associated vault are located on a slope on the northeast side of the island between the old piggery and the concrete boundary wall that originally separated the City of Boston property from the U.S. military reservation on the southern half of Deer Island. It is referred to hereafter as the northeast, or new, cemetery.

A more intensive archaeological survey was carried out in 1987 by PAL to assess the significance of the historic period cemetery. The survey was carried out in two basic stages: documentary research, to be followed by site verification.

The specific objectives established for the documentary research were: (1) to establish the period of active use of the cemetery identified during the reconnaissance survey; (2) to establish if this cemetery is older than the 1908 mausoleum associated with it; (3) to determine, if possible, whether the known cemetery contains any burials that were removed from earlier nineteenth century plots formerly located on other sections of Deer Island; (4) to determine if the cemetery plot near the 1908 mausoleum could contain older (nineteenth century ?) reinterred burials; (5) to consult records maintained by the military (Army Corps of Engineers) for any information relevant to the final disposal of burials from Resthaven Cemetery on the southern tip of Deer Island; (6) to determine when Resthaven Cemetery was first actively used by the correctional facilities; and finally, (7) to locate documentary sources describing the methods used in the burial of almshouse or prison inmates on Deer Island (individual graves, large trenches, etc.).



MASSACHUSETTS WATER RESOURCES AUTHORITY

FIGURE 6.3.1-1
LOCATION OF CEMETERY INVESTIGATIONS

What this research has revealed is that the new northeast cemetery plot, or new Resthaven, is much larger than expected from the cursory field inspection of the site. Judging by the 1929 photo shown in Figure 6.3.1-2, the cemetery extended from the northeast wall of the old piggery to the cement boundary and wall from the sea wall at the top of the slope to the mausoleum at the foot of the slope. The many wood scraps originally thought to be picket fence remains and, therefore, assumed as markers of the plots' boundary, were more likely remnants of the wooden crosses which were once maintained to mark the graves in the tightly packed cemetery.

As no evidence has been found suggesting the removal of these burials to another location, it is expected that some 4,160 to 4,500 bodies remain interred in the new cemetery. The only evidence for the plan of burials within the new cemetery is the 1929 photo. It suggests that either individual graves were located very close together or that individual crosses marked bodies buried in trenches. The latter possibility seems most probable for the reinterments due to the age and likely condition of the earlier burials when transferred from old Resthaven Cemetery, where evidence indicates the bodies were buried eight to ten per trench.

Additional archaeological testing was undertaken in May 1987. The results will be included in the final report. Two methods of remote sensing techniques, soil resistivity and electron magnetometry, have been used to attempt to discern any patterns of disturbance that may be present in the area of the historic period cemetery and could possibly signify burials. Experience with soil resistivity testing at several historic period cemeteries ranging in age from the late seventeenth to nineteenth centuries has indicated that more recent burials have greater resistivity. A soil resistivity survey of the Deer Island cemetery has been used to identify the probable location of burials prior to any actual subsurface testing. Electron magnetometry works in a similar manner and has been used as a second verification method. The results of the soil resistivity and electron magnetometry surveys have been used to develop a map or plan of the location of soil anomalies. This map was subsequently used in consultation with the Massachusetts Historical Commission, to plan an effective subsurface testing or burial verification program for the cemetery.

The primary objectives or tasks for the recommended fieldwork have included: (1) determination of the horizontal extent of the cemetery through systematic subsurface testing; and (2) collection of sufficient data to reconstruct the internal configuration or plan of the cemetery and general mode of burial (individual graves, multiple burials in trench, etc.) used at this site.

Actual subsurface testing within the known cemetery is being performed in July, 1987, to verify the existence of burials. This fieldwork involves the use of both machine assisted and hand excavation techniques. A small backhoe or similar machine will be used to excavate a series of narrow trenches through the cemetery to expose the upper surface of filled grave shafts. Machine excavated trenches could be oriented in several ways within the cemetery area. Subsurface anomalies located by soil resistivity testing that represent potential unmarked burials could be tested with judgementally oriented trenches placed on the locations of these anomalies. Other deliberately placed trenches will be necesary to identify the horizontal limits of the cemetery if it is found to actually contain unmarked burials. Given the moderately sloping surface of the cemetery, the machine excavated trenches will probably have

MASSACHUSETTS WATER RESOURCES AUTHORITY

FIGURE 6.3.1-2
1929 DEER ISLAND PHOTOGRAPH
SHOWING NEW RESTHAVEN CEMETERY
UPPER CENTER

to be oriented perpendicular to the natural slope. since it would be unlikely that a backhoe or similar equipment could operate across this slope. These trenches will be excavated with machinery (small backhoe or front-end loader) only to a depth suficient to identify a filled grave/burial shaft. Once a definitive grave shaft or fill has been identified, hand excavation will be used to complete the investigation. Excavation with hand tools would proceed only until the presence of human skeletal remains can be verified within an identified grave or burial. Once human skeletal remains have been positively identified they will be left in situ and the State Archaeologist will be notified.

Representative soil profiles will be recorded from all machine excavated trenches and scaled drawings made of profiles exposed during the excavation of specific burials. The locations of trenches excavated during the archaeological investigation and any burials identified during the survey will also be mapped. All aspects of the archaeological investigation will be recorded in documentary photographs (color, black/white). This would include photographing any burials located and positively identified during fieldwork. The final report summarizing the results of the archaeological testing will be included in the Treatment Plant EIR/EID, Volume III.

6.3.2 DEER ISLAND HOUSE OF CORRECTION

History

Owned by the City of Boston since 1634, Deer Island in Boston Harbor has proven a useful place for purposes that needed a site, but that had to be set apart from a populated area. Its use has included the detention of Indians and the quarantine of contagious immigrants.

In 1850 the City sited a municipal almshouse there, which became the first in a complex of institutions serving the poor, the criminal and the delinquent. The almshouse was known as the House of Industry; other buildings, such as a reformatory, and schools for pauper boys and girls, were added in the next three decades. In the 1890's the whole complex started being used for the detention of prisoners, and was called the House of Correction, the name still used today.

The Deer Island group of institutions for many years was self-sufficient, providing its own food from animals and farming. Dairy barns were built as late as the 1950's but farming has now ceased. The Island was accessible by boat, and the Penal Institutions Department maintained its own steamboat to transport inmates between islands and the mainland. In 1940 the Island was connected by causeway to Point Shirley in Winthrop.

Deer Island has not previously been surveyed for historical significance. Consequently. none of the buildings are listed in official inventories or have been identified as eligible. The main points of historic interest are the following:

1. Administration Building (ca. 1850. 1929. 1949)
This building incorporates major sections of the Deer Island Almshouse (also known as the House of Industry), designed by Gridley J. F. Bryant (1816-1899) with the assistance of Louis Dwight

of the Prison Discipline Society. The original building was of brick, in Italianate and vernacular style.

Fire damage in 1929 and 1949 led to the removal of the roof and portions of the building. Modern sections were added at the back.

Interior hallways and offices on the first floor have woodwork, matchboard panelling, and cast-iron columns which are apparently original. The cell-block appears to date from the late nineteenth century, and is probably the addition designed by City Architect Edmund Wheelwright in 1892.

The building is now used as administrative offices, reception and cells for new prisoners, training and schoolrooms, and workshops. The building appears structurally sound but worn and neglected.

2. Hill Prison (1902-04)
This building appears to be substantially unaltered. It was built as a women's prison, but is now the main prison in the complex, occupied solely by men.

The architect was A. Warren Gould, active in the 1890's in Boston, where he designed a number of houses and buildings in Dorchester, including Whiton Hall for the Dorchester Women's Club. He moved to the Pacific Northwest and died in Seattle in 1922.

The building is T- Shaped. The two wings contain cell-blocks, the rear wing dining and recreational facilities. The building is of loadbearing brick, 24 in. thick at first floor level; the foundations and entrance facade are granite. The floor construction is reinforced concrete, and brick vaults span the cell-block open areas. Interior supports are cast-iron columns and masonry. The pitched roofs are covered with slate.

The style of the building is classical revival. The central section has a granite facade in the lower half, brick in the upper half. In the granite section, two projecting bays flank an arched entrance in Palladian style, above which is a recessed balcony set in a semicircular arch. Above are a series of vertical brick pilasters between windows, topped by an entablature and surmounted by a hipped roof with clipped dormers and a prominent cupola.

The two wings contain a series of wide brick pilasters alternating with narrower barred windows arched at their tops. Since these windows give onto the open space of the cell-blocks, there are no floors behind them, and the windows are virtually continous strips. Above is a broad entablature. The roof is pitched, and has ventilators at the ridge, which were once open roof viewing platforms. The end walls of the wings have the same pilaster and arched window motif of the front and rear elevations; the windows are bricked up.

The rear wing, also roofed with a pitched slate roof, has a series of brick semicircular arches, with windows at each floor level. In the uppermost floor -- the recreation hall -- the upper section of the window is blocked with plywood. The end wall of this wing is the stage wall, and is solid brickwork. The outer skin of this wall collapsed recently, and has been

replaced.

Inside the building, most of the spaces are utilitarian. There is some architectural interest in the front entrance hall and in the recreation hall, which still retains original woodwork in the doorways, stage and proscenium arch, and balcony.

The building appears to be structurally sound. Inside, all surfaces show signs of much wear, poor maintenance, makeshift repairs and careless painting.

3. Superintendent's Office (1930)
This red brick building, situated on the waterfront opposite the Administration Building, originially housed doctors and other professional staff of the Deer Island HOC.

The building, which resembles a traditional single-family home, is Georgian Revival in style. It is composed of a rectangular 2-1/2 storey block with a high-pitched slate roof and a flat-roofed single storey service wing to the side. It is faced with Flemish Bond red brick and has a cast stone foundation and details.

The main facade has three bays of windows on either side of a central entranceway consisting of a pair of Corinthian columns and a segmental arch. The front slope of the roof has five gabled dormers; the rear of the structure has four dormers and four pairs of french doors leading onto a cast-stone terrace.

The Superintendent's Office was initially believed to date from circa 1910, based on visual analysis. Subsequent research, however, has indicated that it was constructed in 1930 to replace the original doctor's wing destroyed in the fire in the Administration Building in 1929. The structure was designed by the M.A. Dyer Company, a Boston architecture and engineering firm.

Subsequent to its use as the doctors' house, the structure became the Penal Commissioner's residence. Beginning in 1973, it housed inmates participating in the Work-Release program. In 1985, the building was renovated for use as office space. This renovation resulted in considerable alteration to the interior and the replacement of the original windows with vinyl copies.

4. Ancillary Buildings
  a. Garage - 20th century.
  b. Commissary - 20th century. This building, previously three and a half stories, was reduced to a one-storey building in 1946.
  c. Dormitories (former Dairy Barns) - 1957 and 1958. Architect, Joseph F. Page.
  d. Shower Block - probably the former Poultry House, 1957. Architect, Joseph F. Page.
  e. Chapel - 1950's.
  f. Power Plant - 1958. Engineers, J. M. McKusker Associates.
  g. Dormitory and Laundry (opposite Hill Prison) - this building may be a remnant of the nineteenth century pauper girl's school.
  h. K-9 Quarters - 1980's. On site of former piggery.

i. Work Release House - 1920's (?)
j. Sheet Metal Shop - 20th century.

5. Site Plan (ca. 1850 to present)
The Deer Island House of Correction consists of a grouping of major and ancillary buildings informally sited in an institutional yet rural setting.

The buildings form two clusters. Near the water's edge, the predominant building is the Administration Building, sited parallel to the main road that traverses the island. Opposite the Administration Building is the Superintendant's Office; nearby is the Work Release House. Behind the Administration Building and parallel to it are a Garage and Commissary.

Up on the hill the predominant structure is the Hill Prison, sited on a street sometimes referred to as Hill Prison Street. Across from the Hill Prison is the Dormitory and Laundry. Next to the Hill Prison are two Dormitories, a Chapel, and Shower Room, and the Power House. Below and across a road is the Sheet Metal Shop. Behind the Hill Prison are the K-9 Quarters.

The buildings are informally set on the site which has a character that is institutional, industrial and rural. There is a loop road that gives vehicular access to all buildings. It is paved, but without curbs in most places. The largest expanse of paved area is between the Administration Building and the Garage and Commissary. Stone retaining walls and foundation walls of demolished buildings occur on the site. Cyclone fencing and wooden telephone poles are in evidence. Trees, bushes and an overgrowth of grass contribute to the rural character of the site.

Significance

The Massachusetts Historical Commission reviewed the historical and architectural survey in December 1987 and made the following finding about the Deer Island House of Correction's historical significance (see Appendix E):

> We . . . found that the Deer Island prison complex does not meet National Register of Historic Places Criteria, but that several cxomponents individually meet NR criteria.
>
> While individual components of the Prison Complex do retain integrity to their period of significance, the complex as a whole does not, having been altered through the construction of numerous small utility buildings in the 1940s, 1950s, and 1960s and through the demolition or substantial alteration of original elements and significant later structures, such as the ca. 1850 House of Industry and the Pauper Boys' School.
>
> Components considered to retain integrity to their period of significance and to meet National Register criteria A and C on the local level are the following:
>
> Hill Prison (1902-04) - Classical Revival building retaining significant elements of its

design; significant for its associations with the development of institutional controls in the city of Boston; as an illustration of the continued usage of the Harbor Islands as the historic location of undesirable social institutions (Boston's institutional fringe) and architecturally as a good example of turn-of-the-century institutional design and practice, reflecting current philosophies regarding criminal justice and social reform.

The Superintendent's Office (ca. 1910) is an excellent example of Georgian Revival architecture in a good state of preservation. Historically, the office reflects the importance and high status of the Superintendent in its prominent siting and imposing design.*

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*Further research has shown that this building was built as the Doctor's House in 1930.

6.3.3 DEER ISLAND PUMPING STATION

History

In 1889, legislation, prompted by reports of the Massachusetts State Board of Health on pollution of Boston Harbor, authorized the formation of the Boston Metropolitan Sewerage Commission. By 1900, the North Metropolitan Sewerage System, serving the 14 cities and towns of the Commission's northern region, was fully operational.

The North Metropolitan system's 74 miles of sewer lines connected nearly 1,000 miles of local lines and pumped to an outlet in the Boston Harbor at Deer Island. The Pumping Station at Deer Island was the largest of three stations constructed to pump sewage through the North Metropolitan system. Constructed in phases in the period from 1894 to 1900, the Deer Island Pumping Station's development reflected the growing needs of the region's burgeoning population.

The Pumping Station at Deer Island lies on the southwesterly side of the island about midway down its length. Actually a complex of five attached buildings, the development of the station reflects the development of the North Metropolitan Sewerage System which it served. Completed in three phases between 1894 and 1899, the complex contains a Screen House, Coal House, Boiler Room and two Engine Rooms. The buildings give the appearance of a single structure, designed in a compatible manner by Arthur F. Gray, architect for the stations at Charlestown and East Boston. Though operated in the periods between construction, it became fully operational in May of 1900. The Station was in operation until 1968 when the Deer Island Sewage Treatment Plant was completed. The building, still containing the old machinery, is now abandoned. To the southeast of the pumping station complex is a two-storey shingle structure referred to as the Farmhouse.

Looking east along the westerly elevation of the drumlin, the Pumping Station buildings are, from left to right:

1. Screen House (ca. 1895)
A two-storey brick, granite and terra cotta structure 27 ft x 23 ft. Built in a simple vernacular industrial style with Queen Anne - Romanesque elaborations and detailing, it has a hipped roof of slate with terra cotta tile coping and is surmounted by a cupola, now only partially extant.

The building covers the screen shaft of the pumping station system and contains machinery for hoisting and pressing. Sewage was screened with double rows of wrought iron bar cage screens before it was put through the pumping machinery. The Screen House and the adjacent Coal Pocket were constructed after the Boiler Room and the first Engine Room.

2. Coal Pocket (ca. 1895)
A one-storey brick, granite and terra cotta building, 74 ft x 34 ft with a dynamo room attached. Styled similarly to the Screen House, it also has a slate pitched roof punctuated by dormer-type openings and terra cotta tile coping.

The engines for the pumping station were powered by coal burned in the boiler room until the facility was converted to diesel fuel in the 1950's. The Coal Pocket was designed to hold 600 tons of coal.

3. Boiler Room and Chimney (Sept. 1894)
A one-storey brick, granite and terra cotta structure, 63 ft x 35 ft with a height of 17 ft to the roof trusses and an accompanying masonry chimney 125 ft in height. The structure is styled in a vernacular Romanesque with Queen Anne details, slated pitched roof with terra cotta tile coping and topped with a ventilation structure. Converted from coal to diesel in the 1950s, the boilers still remain intact. The boiler room and the first engine room were the initial structures built for the pumping station, which shares its pattern of boiler room-engine room with the stations at East Boston and Charlestown.

4. Engine Room (first) (Sept. 1894)
A one-storey brick, granite and terra cotta structure, 100 ft x 31 1/2 ft, with a height of 15 ft to the roof trusses. Styled in a vernacular Romanesque with Queen Anne detailing, it also has a pitched slate roof punctuated by dormer-type openings and with terra cotta tile coping. Similar to the stations at East Boston and Charlestown, it was originally equipped with two triple-expansion Corliss type steam engines.

5. Engine Room (second) (ca. 1899)
A two-storey brick structure approximately 50 ft by 50 ft with a hipped slate roof. The structure is built in a more formal style with Romanesque details of round-headed arches, brick patterns to create circles, and horizontal lines denoting function.

Because of a need for increased system capacity, an extra pump and engine were added to the Deer Island Pumping Station and housed in this structure. The machinery is still extant.

6. <u>Farmhouse</u> (ca. 1900)
Approximately 300 feet to the southeast of the Pumping Station stands a two-storey wood and shingle Queen Anne/Colonial Revival structure that is known as the Farmhouse. Physical evidence indicates that the original structure, a simple rectangular two-storey barn, received later additions, probably around the turn of the century. The original barn forms the north wing, while the later construction consists of the central stable-like area and the attached south wing. The south wing apparently was designed and used as a residence for employees of the Pumping Station, and possibly the Superintendent. Employees of the Pumping Station at various times used the north and central wings as a locker building, tool room, stable, and garage. The M.D.C. currently uses the Farmhouse as a storage area for old documents, tires, and sand; it is in dilapidated condition.

Significance

The Massachusetts Historical Commission, in its review of the historical and architectural survey of Deer Island, concluded the following about the Pumping Station (see Appendix E):

> . . . we find that the Deer Island Pump Station Complex appears to meet National Register Criteria A and C.
>
> The Pumping Station meets criteria A and C,
>
> 1) as a substantially intact sewage pumping complex illustrating the development of the Metropolitan District Commission, one of the earliest major environmental management agencies in the country, and of the City of Boston and its surrounding area, which experienced substantial growth at the turn of the century and
> 2) as an architecturally distinguished pair of buildings in the Romanesque Revival and Queen Anne styles. The pumping station, built between 1849-99, is notable for its high quality design and materials while the adjoining farmhouse is a particularly good example of Queen Anne/Shingle Style architecture.

References

References used to document the historical and archaeological features of Deer Island are listed in Appendix E, Archaeological Documentary Research Undertaken by Public Archaeology Laboratory, Inc.

Section 7

7.0 DEVELOPMENT OF EARLY SITE PREPARATION ALTERNATIVES

The purpose of this section is to describe the parameters which influence the development of alternative concepts for Deer Island early site preparation. The general scope of early site preparation includes excavation and final disposal of the grit and screenings previously dumped on Deer Island, protection of the existing outfall pipes, demolition and clearing of the Ft. Dawes facility and water reservoir, excavation of large volumes of earthen materials, and landform construction. The overall goals of site preparation are as follows:

- Expedite the excavation and final onsite disposal of grit and screenings and the movement of the large volume of earth associated with the drumlin in the center of the island. Early planning and action will serve to aid the ability of MWRA to meet the 1995 date for the completion of primary treatment facilities, as well as subsequent milestones.

- Prepare the various areas to the required elevations for subsequent construction contract work and do so in a phased approach consistent with the project needs and in a cost-effective manner.

- Maximize the placement of excavated materials onsite, thereby minimizing offsite movement and disposal.

- Construct landforms in perimeter areas of the site to provide visual and noise buffer zones between the plant and the surrounding areas. This includes early construction of a noise barrier berm and landform at the northern end of the island between Winthrop and the plant.

- Minimize environmental impacts both off-island and on-island through careful planning and the incorporation of measures to mitigate impacts.

- Minimize disturbance of the existing treatment plant operation until new primary treatment facilities become operational.

The parameters which influence the development of early site preparation have to do with physical constraints and plant design concepts, construction considerations, environmental and institutional factors, and schedule restraints.

Physical constraints include the limited size of Deer Island, the large volumes of materials that must be moved, the large size of the new primary and secondary treatment facilities, and the hydraulics of the treatment system. As previously indicated, several assumptions were made to define a representative treatment facility to support early site preparation planning since plans for the new facilities are not expected to differ significantly for each of the treatment system alternatives. The representative treatment facility "footprint" is based on a system with stacked primary clarifiers, activated sludge aeration tanks, stacked secondary clarifiers, and disinfection. Areas are also reserved for residuals and pier facilities. Areas which

remain around the perimeter are assumed to be available for landform development, with the exception of an historic period cemetery northeast of the Hill Prison building. Figure 7-1 illustrates the general concepts for the treatment facility site layout and landforms.

Construction considerations include planning the construction in phases and by contract packages to ensure an efficient, timely, and manageable project.

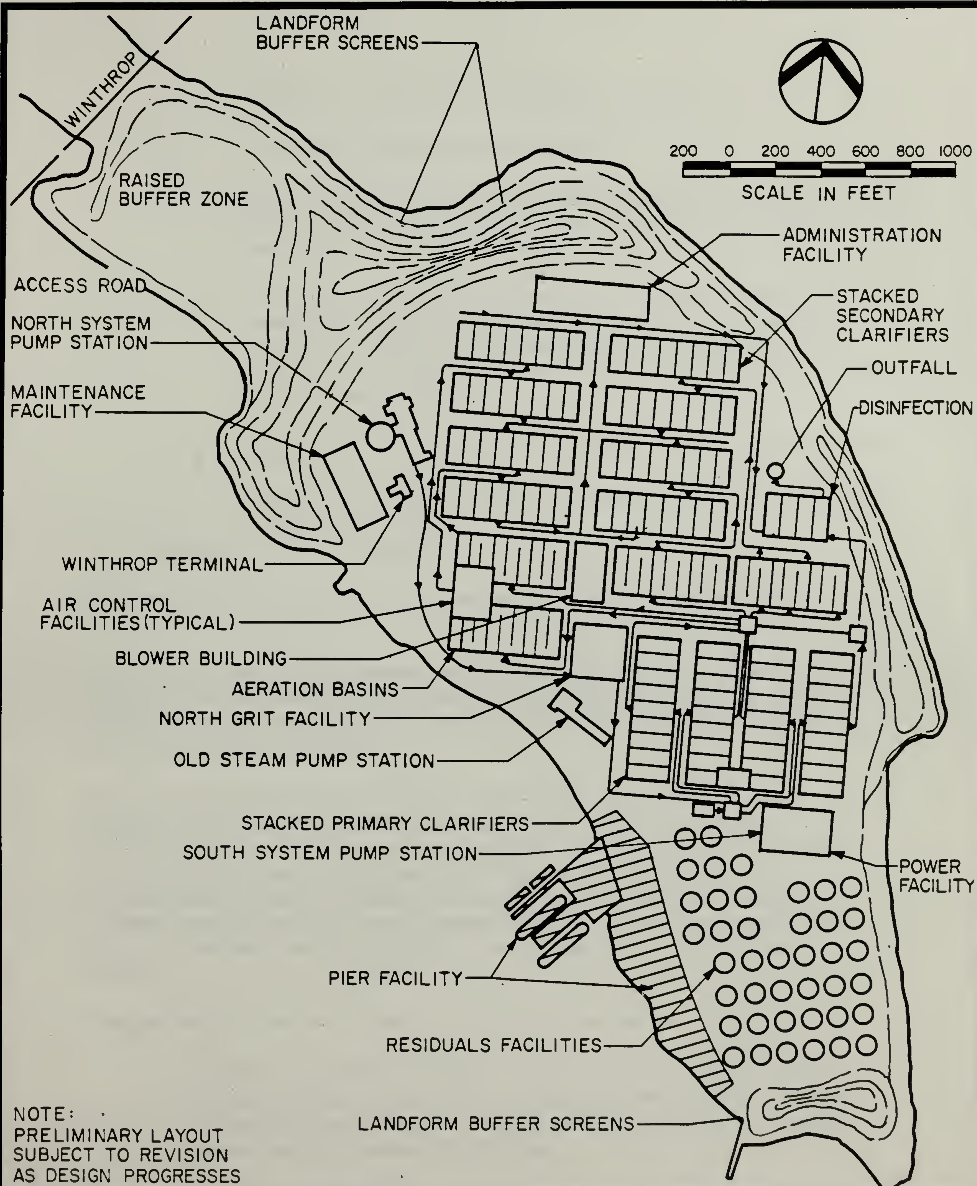
Environmental and institutional factors focus on the need to minimize impacts. MWRA has committed to using numerous measures to mitigate impacts, with particular attention to overload transportation limitations, noise control and odor control. During early site preparation, odor will be of particular concern during the excavation of the grit and screenings disposal areas. To minimize odor potential, excavation of the grit and screenings will occur, to the extent possible, during the cooler months of the year. Other environmental factors that are important to site preparation are dust control, erosion and sediment control, and shoreline protection.

The primary institutional constraint is the presence of the Deer Island House of Correction. Early removal of the prison operation will significantly facilitate site preparation. Applicable state law requires that the House of Correction be relocated by 1989, a timeframe that is consistent with the needs of early site preparation. Any delay in relocation will conflict with early site preparation and may require that special measures be taken to mitigate the impacts on the occupants of the House of Correction. As a minimum, early access to northern areas of the corrections facility property will be required if a landform buffer protecting Winthrop from the construction activities is to be constructed.

Another institutional constraint is the presence of an historic period cemetery. Archaeological studies are underway to assess the historical value of the cemetery and the need to protect it. Phase II field work was completed in July 1987. Results will be reported in Volume III, Treatment Plant. For early site preparation, the availability of this area cannot be assumed. Volume III will also address the treatment of historic structures on Deer Island since early site preparation activities will avoid and protect these structures as appropriate.

The schedule constraints for the project are largely established by the Court-imposed major milestones for the cleanup of Boston Harbor. As described in Section 5.1.1, the resulting general concept is a three-phase development of the island consistent with maintaining the operation of the existing treatment plant while new primary treatment facilities are constructed on the southern half of the island, followed by the construction of the secondary treatment facilities in the area of the existing treatment and correctional facilities. Specifically, as part of the first phase, early site preparation activities are those activities identified below that can proceed on Deer Island at an early date:

- Protection of existing outfall pipes against heavy construction equipment traveling in this area and/or excessive standing loads (e.g. landforms or on-island material storage in the area).



MASSACHUSETTS WATER RESOURCES AUTHORITY

FIGURE 7-1
SITE LAYOUT
SECONDARY TREATMENT FACILITIES
DEER ISLAND

- Grit and screenings removal, stabilization, and reburial.

- Provision of a back-up service water system.

- Demolition and removal of the plant water reservoir and Ft. Dawes facilities with the areas filled in and graded to meet treatment facilities construction elevations.

- Commencement of first phase drumlin removal to support the early start of construction of the primary treatment and residual facilities by late 1990. A goal is to construct early in the schedule a large berm and landform at the northern end of the island to provide a noise and visual buffer between Winthrop and Deer Island activities.

- Preparation of an area near the on-island piers for the concrete batching plant.

- Relocation of island access facilities (i.e., entrance road, guard house, parking lot and security fencing).

7.1 IDENTIFICATION OF ALTERNATIVES

The purpose of this section is to identify the alternatives for early site preparation which are further evaluated in Section 7.2.

The general sequence of site preparation activities is described in Section 5.2, Scheduling Considerations. Differences in approach generally have to do with the availability of prison property, when and where the excavated material is moved on-site and the extent of double-handling of the excavated material.

The only early site preparation alternatives to be evaluated by the various environmental, technical, institutional and cost criteria is the relocation of the grit and screenings that must be done before major drumlin excavation can begin. In an effort to expedite portions of the construction, this activity will be performed early, prior to the availability of the on-island piers. The goal is to dispose of this material onsite in compliance with applicable regulatory requirements. As a mitigation measure, this early site preparation excavation will be done in the cooler months to the maximum extent feasible to minimize off-site odor potential.

Two principal alternatives exist for the grit and screenings treatment and disposal:

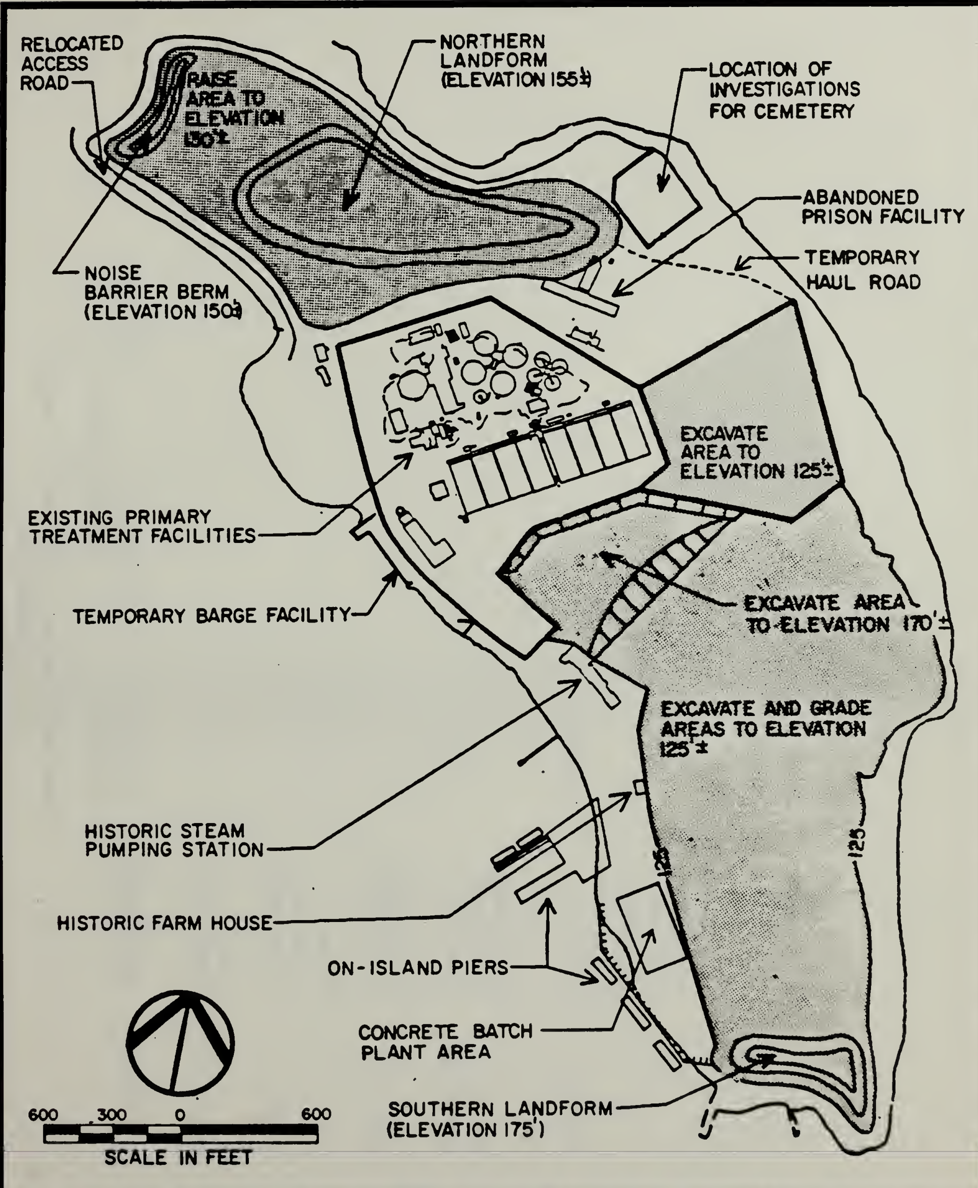
- Alternative A, Chemical Stabilization - Grit and screenings will be excavated, passed through a shredder to reduce the size of large objects, and chemically stabilized by the addition of chemical reagents. Product material will be hauled to an unlined disposal area at the southern tip of the island.

- o Alternative B, Secure Landfill - Grit and screenings will be excavated and hauled to a previously prepared, doubly lined, on-site disposal area. Landfill design will be consistent with DEQE policies for sludge-only landfills.

An alternative schedule plan exists which may affect both early site preparation and the later phases of site preparation activities. The alternate schedule plans, based on the availability of the prison property, are as follows:

- o Schedule Plan 1 - This plan assumes that the prison operation on Deer Island ceases in 1989, thereby allowing complete access to the northern end of the island. The large landform planned for this area could then be constructed with a minimum of interference. Excavated material could be used as fill in areas presently below the required final elevations and in landform areas. This plan includes the construction of a haul road along the eastern perimeter of the island to provide access to the northern area. With this plan, the need to transport material off-island can be deferred and landform development can proceed in the most orderly manner with a minimum of interference. Early site preparation associated with Schedule Plan 1 is shown in Figure 7.1-1. Table 7.1-1 contains a summary of the earthwork quantities associated with this plan.

- o Schedule Plan 2 - Although this plan is based on the DCPO schedule of maintaining the prison operational until 1992, in an effort to provide some buffer between Winthrop and the Deer Island construction activities, it is assumed that MWRA will seek to negotiate a limited access to the House of Correction property, specifically the use of the recreation field and the adjacent land forming the northern neck of Deer Island. MWRA would relocate the prison recreation area during early 1989/90 even though the prison will still be operating and the northern portion of the island would be used to construct a raised landform and noise barrier berm. This plan greatly restrains the development of the large landform at the northern end of the island during early site preparation as shown in Figure 7.1-2, and will require extensive construction planning to meet the imposed mitigation schedule date for the start of construction of the primary facilities. Table 7.1-2 contains a summary of the earthwork quantities associated with this plan. Other scheduling plans were originally evaluated, in which it was assumed that there would be no access to either the prison area itself nor the northern recreational area. However, the result would have meant the double-handling of over one-half million cubic yards of soil, additional noise impact on the nearby Winthrop residents, and an increase in cost of nearly $3 million over and above the next most costly schedule plan.



MASSACHUSETTS WATER RESOURCES AUTHORITY	FIGURE 7.1-1 EARLY SITE PREPARATION FOR DEER ISLAND - SCHEDULE PLAN 1 DECOMMISSIONED PRISON

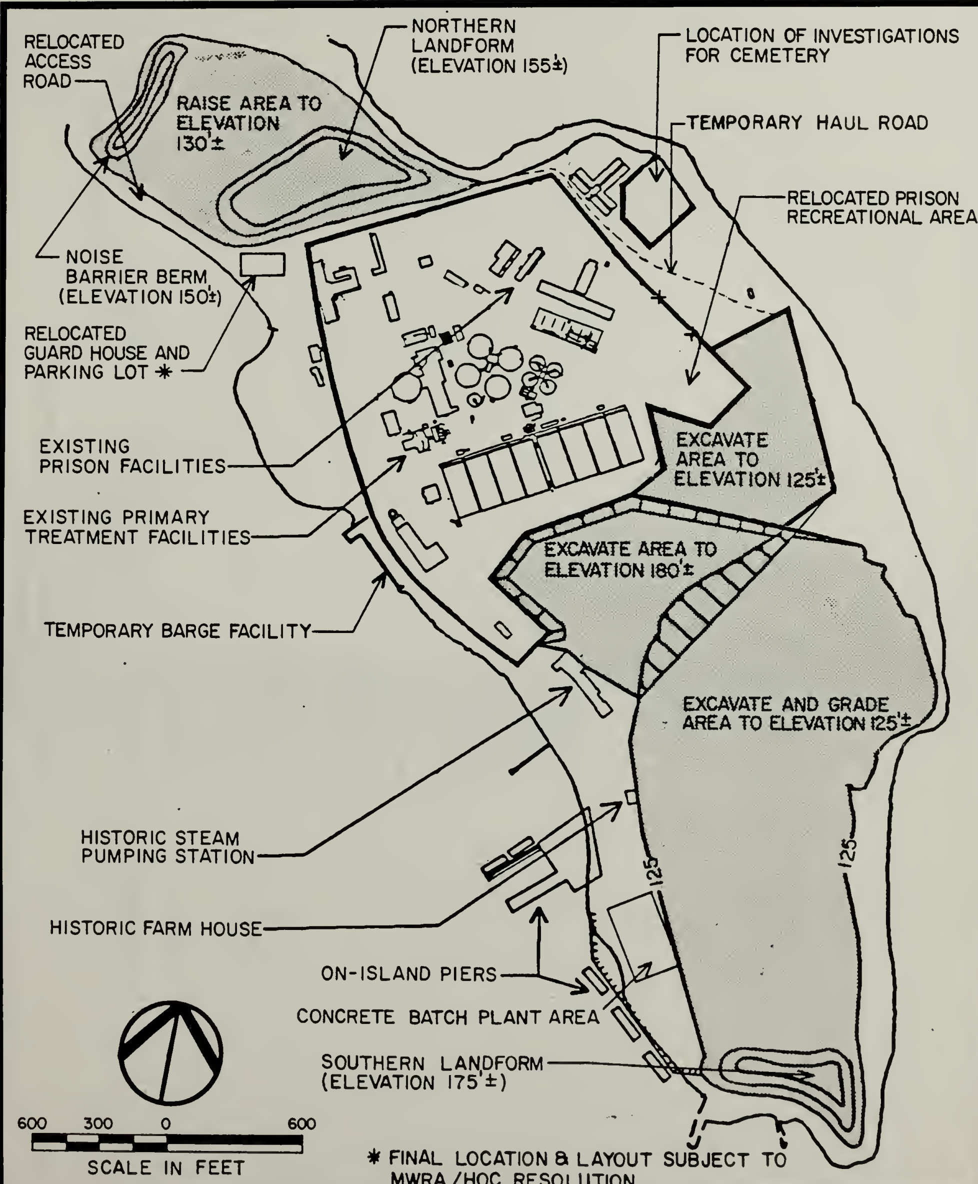
Table 7.1-1
Early Site Preparation Quantity Summary
Schedule Plan I
(Prison Decommissioned by 1989/Total Area Available)

SCHEDULE	DESCRIPTION	EXCAVATED MATERIAL(YD^3)	PLANNED REUSE (YD^3) ON-ISLAND	OFF-ISLAND
1988-89	Protect existing outfall.			
1988-89	Provide alternate service water system			
1989	Relocate Island access facilities	--		
Winters 1988 and 1989	Remove and dispose of grit and screenings.	85.000	85.000	--
1989-1990	Excavate central drumlin and demolish existing cooling water reservoir	1,600.000	---	---

Table 7.1-1
Early Site Preparation Quantity Summary
Schedule Plan I
(Prison Area Available by 1989)
(continued)

SCHEDULE	DESCRIPTION	EXCAVATED MATERIAL(YD^3)	PLANNED REUSE (YD^3) ON-ISLAND	OFF-ISLAND
1989-1990	Construct earth berm and platforms -North area -South area	---	1,600,000	---
1990	Prepare area for concrete batching plant.	13,000	13,000	---
1988-1990	Demolish existing facilities	47,000	39,000	8,000
	TOTALS	1,745,000	1,737,000	8,000

* Estimated maximum. Will attempt to retain all on-site.



MASSACHUSETTS WATER RESOURCES AUTHORITY	FIGURE 7.1-2 EARLY SITE PREPARATION FOR DEER ISLAND SCHEDULE PLAN 2-OPERATING PRISON-ONLY RECREATIONAL AREA AVAILABLE UNTIL 1992

7.1-2

Early Site Preparation Quantity Summary

Schedule Plan 2

(Operating Prison/Recreation Area Available Only)

SCHEDULE	DESCRIPTION	EXCAVATED MATERIAL(YD^3)	PLANNED REUSE $(YD)^3$ ON-ISLAND	PLANNED REUSE $(YD)^3$ OFF-ISLAND
1988-89	Protect existing outfall.			
Winters 1988 and 1989	Remove and dispose of grit and screenings.	85,000	85,000	---
	Provide alternate service water systems.			
1989	Relocate access facilities and relocate/ build prison recreation area			

Table 7.1-2
Early Site Preparation Quantity Summary
Schedule Plan 2
(Operating Prison/Recreation Area Available Only)
(continued)

SCHEDULE	DESCRIPTION	EXCAVATED MATERIAL(YD^3)	PLANNED REUSE $(YD)^3$ ON-ISLAND	OFF-ISLAND
1989-1990	Start excavation of central drumlin and demolition of existing cooling water reservoir.	1,200,000	---	---
1989-1990	Construct earth berm and platforms -North area -South area	---	1,200,000	---
1990	Prepare for concrete batching plant.	13.000	13.000	---
1988-1990	Demolish existing facilities	47,000	39,000	8.000
	TOTAL	1,345.000	1.337.000	8,000

7.2 DESCRIPTION AND EVALUATION OF ALTERNATIVES

The new primary facilities section will be located in the area of the large existing drumlin southward while the secondary treatment facilities are to be located in the interior of the island. The northern area and areas east and south along the shore line are dedicated to berm construction which will form buffer screens to reduce noise and visual impact on the neighboring communities.

Major site preparation difficulties lie in moving excavated materials on-island and off-island. These difficulties are related to restrictions presented by the mitigation measures, the U.S. District Court imposed milestone schedule, and the restricted island site which will be made even more confining if the prison facilities area is not available during the early site preparation period. The early site preparation work is being initiated to help relax site constraints imposed on other major construction activities scheduled to start after the on-island pier facilities are completed and operating in the fall of 1989. Other goals of site preparation planning are to keep the maximum quantity of excavated materials on-island in order to reduce vehicular traffic impacts on the neighboring communities, and to prepare a level platform for the construction contracts.

The only technical alternatives to accomplish the early site preparation activities are related to existing grit and screenings relocation - namely, chemical stabilization and a secure landfill disposal.

For the chemical stabilization alternative, grit and screenings will be excavated, passed through a shredder to reduce the size of large objects, and chemically stabilized by addition of chemical reagents. The Chemfix process was selected as the basis for evaluating the effectiveness and costs of the stabilization process. Product material will be hauled to an unlined disposal area at the southern tip of the island where the material will be spread and the area developed in lifts. Ultimately, up to 25 ft of soil will be applied on top of the stabilized material as part of landform construction. The rate of processing in the stabilization step may require that excavation and processing occur over the cooler months of both 1988 and 1989 in order to minimize odor potential.

For the secure landfill alternative, grit and sreenings will be excavated and hauled to a previously prepared, doubly lined, onsite disposal area at the southern tip of the island. Landfill design will be consistent with DEQE policies for sludge - only landfills. In this case the liners will consist of a 2 ft thick layer of bentonite treated soil and a synthetic liner. To ensure stability of the landfill, lifts of grit and screenings will be alternated with lifts of onsite soils. The side slopes will be limited to a maximum of 2 horizontal :1 vertical. A 20-ft-thick layer of soil will be placed as the final cover across the top and down the side slopes of the entire landfill area. A leachate collection system will be put in place and the collected leachate conveyed via pipeline to the existing wastewater treatment plant. In order to increase the rate of early leachate generation and thereby decrease the long term generation of leachate, vertical wick drains will be installed at closely spaced

intervals throughout the landfill area. The excavation and transfer of the grit and screenings to the secured landfill will be accomplished within the course of a 6-8 month construction period.

The evaluation criteria for costs, environmental, institutional and technical aspects of these alternatives are described in Sections 7.3 through 7.6. The costs associated with the schedule plans, based on the date of access to prison land, are also discussed in Section 7.3.

7.3 COST EFFECTIVENESS ANALYSIS

7.3.1 GRIT AND SCREENING ALTERNATIVES

The estimated costs for grit and screenings disposal are based on the assumptions made above in Section 7.2 for the chemical stabilization and secure landfill alternatives:

Chemical Stabilization

The cost estimate prepared for this alternative includes costs associated with the following items:

- o Preliminary site grading
- o Excavation and hauling of grit and screening to the chemical process plant
- o Grinding or shredding of excessively large size grit and screenings pieces
- o Chemical stabilization process
- o Hauling and placement of stabilized grit and screenings in the landfill area
- o Excavation, hauling, and placement of the final cover layer

The cost for developing the chemically stabilized grit and screenings landfill, shown in Table 7.3.1-1, is $8.7 million.

Secure Landfill

The cost estimate prepared for this alternative includes costs associated with the following items:

- o Preliminary site grading
- o Liner cost and/or installation (soil and synthetic)
- o Leachate collection system
- o Excavation, hauling, and placement of grit and screenings
- o Excavation, hauling, and placement of intermediate soil layers and final cover layer
- o Installation of wick drains
- o Leachate pumping system

The cost for developing the secure grit and screenings landfill, shown in Table 7.3.1-2, is $4.8 million.

TABLE 7.3.1-1
Summary of Costs
Grit and Screenings Disposal Alternatives

Chemfix Stabilized Landfill

Item	Capital Cost
Preliminary Site Grading	175,000
Excavation and hauling of grit and screenings to the process area	385,000
Grinding, shredding, and chemical stabilization of grit and screenings	3,995,000
Hauling and placement of stabilized waste to prepared landfill	270,000
Excavation, hauling and placement of final cover layer	680,000
Field non-manual personnel	685,000
Overhead distributables	290,000
Capital Cost =	$6,480,000

Project Cost = Capital Cost X 1.35 (Engineering and Contingencies) =
6,480,000 X 1.35 = $8,750,000

Operating and Maintenance = 0

Present Worth Cost = $8,750,000 (in this case it is assumed equal to the Project Cost because of the short construction time frame and the proximity of the construction year 1989 to the 1990 Base Year)

TABLE 7.3.1-2
Summary of Costs
Grit and Screenings Disposal Alternatives

Secure Landfill

Item	Capital Cost
Preliminary site grading	175,000
Liner (clay and synthetic)	420,000
Leachate collection system (PVC underdrain and sand drain layer)	325,000
Provision for off-loading 17,000 yd^3 sand from barges	18,000
Excavation, hauling and placement of grit and screenings	385,000
Excavation, hauling and placement of intermediate soil layers and final cover	1,265,000
Installation of wick drains	20,000
Leachate pumping system	24,000
Field non-manual personnel	691,000
Overhead distributables (Insurance, office space, supplies, shops, on-site transportation etc.)	305,000
Capital Cost =	$3,628,000

Project Cost is the capital cost X 1.35 to allow for engineering and contingencies.
Project cost = 3,628,000 X 1.35 = $4,898,000.

Operating and Maintenance includes leachate pumping for 2 years after secure landfill completion = $1000/yr X 2 = $2,000. The volume of leachate drainage after this time period is negligible.

Present Worth Cost = $4,898,000 (in this case it is assumed equal to the Project Cost because of the short construction time-frame and proximity of the construction year 1989 to the 1990 Base Year.)

7.3.2 EARLY SITE PREPARATION SCHEDULE PLANS

As previously discussed, the prison decommissioning could significantly affect the schedule for some early site preparation activities, particularly drumlin excavation and landform construction. Therefore, two schedule plans have been identified to reflect 1) decommissioning to the prison by 1989, (as legislated) and 2) decommissioning of the prison by 1992 but early access to the northern recreation area permitted. Because of the additional area available for landform construction, Plan 1 includes the excavation, hauling and placement of approximately 25 percent more earth materials than does Plan 2. The estimated costs for these alternate schedule plans are summarized in Tables 7.3.2-1 and 7.3.2-2.

7.4 ENVIRONMENTAL EVALUATION OF ALTERNATIVES

As described in section 7.2 two alternatives were considered for the disposal of the existing grit and screenings:

- o Excavation of the grit and screenings, chemical treatment, and disposal of the stabilized grit and screenings in a landform.

- o Excavation and disposal of the grit and screenings in a lined or secure landfill, which would be designed in accordance with DEQE's sludge-only landfill guidelines.

Both alternatives involve final placement of the grit and screenings within the base of a landform which will be constructed at the southern tip of Deer Island. The finished grade at the top of this landform will provide for at least 20 ft of compacted soil on top of the untreated grit and screenings, or 25 ft of compacted soil on top of the stabilized grit and screenings.

Chemfix Testing Results

An investigation was performed to evaluate the treatability of the existing grit and screenings, and determine costs, schedule, and other requirements for chemical treatment. For this evaluation, the Chemfix* treatment process was evaluated. A brief summary of the results of this evaluation is included below, followed by an environmental evaluation of both disposal alternatives.

The Chemfix process is a series of chemical reactions involving various combinations of chemical reagents, i.e., Portland cement and silica mixed with a waste material such as grit and screenings, to form a chemically and mechanically stabilized product. The Chemfix process has been reported to immobilize or convert potentially toxic heavy metals into less soluble and environmentally stable compounds, and inactivate and control the regrowth of pathogenic microorganisms which may be contained within the untreated residuals.

For this investigation, representative samples of the grit and screenings were taken from each of the four disposal areas located adjacent to the southern face of the central drumlin on Deer Island. The samples were then tested to determine grinding/shredding pretreatment requirements

Table 7.3.2-1
Early Site Preparation Costs

Schedule Plan 1 (Prison Decommissioned/Total Area Available by 1989)

Item	Capital Cost
Protect existing outfall	$ 450.000
Dispose of grit and screenings in secure landfill	3.628.000
Demolish and remove Fort Dawes facilities and cooling water reservoir	2,670,000
Relocate Deer Island access road and site security facilities	175,000
Excavated drumlin and develop landforms*	4,875,000
Provide alternate non potable service water system source for existing plant**	1,100,000
	$12,898,000

Project Cost = Capital Cost x 1.35 = $17,412,000
Present Worth Cost = Project Cost = $17,412,000

*Total quantity of soils excavated is 1.6 million cubic yards.
**Final resolution of requirements for this system are addressed in Volume III, Treatment Plant.

Table 7.3.2-2
Early Site Preparation Costs

Schedule Plan 2 - (Operating Prison/ Only Recreation Area Available)

Item	Capital Cost
Protect existing outfall	450,000
Dispose of grit and screenings in secure landfill	3,628,000
Demolish and remove Fort Dawes facilities and cooling water reservoir	2,670,000
Relocate Deer Island access road and prison security facilities	220,000
Excavate drumlin excavate and develop landforms*	3,525,000
Relocate prison recreation area	100,000
Provide alternate non potable service water system source for existing plant**	1,100,000
	$11,693,000

Project Cost = Capital Cost x 1.35 = $15,786,000
Present Worth Cost = Project Cost = $15,786,000

*Total quantity of soils excavated is 1.2 million cubic yards.
**Resolution of requirements for this system are addressed in Volume III, Treatment Plant.

and optimum chemical treatment requirements. Samples of the treated and untreated grit and screenings were then analyzed to compare their physical, chemical, and microbiological characteristics. The results of the investigation were as follows:

- The grit and screenings must undergo pretreatment by either grinding or shredding, prior to Chemfix treatment. Satisfactory results were obtained using shredding equipment which would be capable of processing approximately 200 cu yd of grit and screenings per day per unit.

- Chemfix treatment of the grit and screening produced a final product having improved physical and microbiological characteristics. The volume increase of the in-place grit and screenings after treatment was determined to be three per cent.

- Neither the untreated grit and screenings nor the chemically treated product were determined to be hazardous wastes, based on the results of EP-toxicity testing (310 CMR 30.155) for metals contained within their leachates. Due to variability of metal concentrations within the grit and screenings samples tested, a direct comparison of the leachates from the treated and untreated samples was not possible.

- Treatment of the entire grit and screenings was estimated to require 10 to 15 months for completion, using a single processing unit. With two units in operation, chemical treatment could be completed within six to eight months.

- The reagent truck traffic to Deer Island was estimated to be nine or ten, 80,000 lb gross weight trucks per week throughout the treatment period, for supporting the chemical requirements of a single processing unit.

*Chemfix is a patented treatment process marketed by Chemfix Technologies, Inc. of Metaire, LA.

Air Emission Control

Both disposal alternatives require the excavation of the existing grit and screenings - the activity with the greatest potential to produce odors. During the sampling of the grit and screenings, which was performed April 21, 1987, it was observed that odors near the sampling trenches were minimal during the early morning when the air temperature was about 50 F. By 10:00 a.m., however, air temperature had risen to approximately 70 F, and strong, sewage odors were observed during the sampling activities. To minimize odor production, removal and disposal of the grit and screenings will only be performed during cooler months of the year.

Chemical treatment of the grit and screenings may have a slight potential to generate more odor than the secure landfill disposal alternative since:

- Chemical treatment will require additional materials handling operations, such as temporary stockpiling and pretreatment. These additional materials handling activities, relative to the alternative disposal method, would tend to expose a

greater surface area of the grit and screenings to the atmosphere.

- o During chemical treatment, the pH of the grit and screenings is raised to above ten due to the addition of Portland cement and sodium silicate. This aspect of the treatment process has the potential to produce ammoniacal odors.

Both alternative disposal methods are judged to have minimal odor impacts to nearby residents because of the mitigating plan for implementation during cooler weather, covering the grit and screenings with intermediate soil layers, and because both alternatives will be implemented over 4,200 ft south of the nearest residents in Point Shirley.

Environmental Criteria

Neither of the alternative grit and screenings disposal methods will displace or directly affect historical and/or archaeological resources on Deer Island. The closest historical structure relative to the grit and screenings disposal areas is the Farmhouse, located approximately 150 ft west of an existing disposal area.

Neither alternative will directly impact floodplains, wetlands and barrier beaches or marine resources. All activities for both alternatives will be performed in locations where these resources do not exist.

Any leachate collected from the grit and screenings secure landfill alternative will be pumped to the treatment plant, and discharged with the treatment plant effluent. The maximum volume of leachate which would be collected over the initial, two-year compaction period for the secure landfill has been estimated at about 5 million gallons. After combination and treatment of the collected leachate with the existing plant influent wastewater, no discernible change in effluent characteristics or associated impacts of the discharge to marine resources would be anticipated.

For the secure landfill alternative, 17,000 yd^3 of sand will be transported to Deer Island by barge to be used in the construction of the leachate collection system. An existing, unused rock wharf, located on the western side of Deer Island and near the existing composting demonstration facility, will be used to off-load the sand barges.

Improvements to the wharf will be made to permit barge unloading consisting of:

- o Placement of two timber mooring dolphins;
- o Removal of approximately 50 to 75 yd^3 of sediment and or rock boulder/debris in front of the existing wharf;
- o Placement of approximately 200 yd^3 of crushed stone at the base of the barge mooring.

Removal (i.e., dredging) of the 50 to 75 yd^3 of sediment/rock will likely be by clamshell bucket. This excavated material will be disposed of in the southern landfill area. Timber

pile driving, and placement of the crushed stone will be by use of the same crane.

Approximately 0.1 acres of benthic habitat would be affected by dredging and placement of the crushed stone required for sand barges. The construction of the barge off-loading area will take only one to two weeks. In view of the limited time and area which would be affected by these activities, the impacts to marine resources are expected to be minimal.

Neither of the disposal alternatives will have a potential to affect rare and endangered wildlife species. Neither alternative will affect existing recreational opportunities, nor the potential for creating future recreational opportunities on Deer Island.

In summary, both grit and screenings disposal alternatives have similar, and minimal potential for impacting the land and marine resources considered.

Traffic

For the secure landfill alternative, truck delivery of the bentonite used for construction of the landfill liner would require approximately one to two trucks per day, for a period of approximately three weeks. Delivery of sand underdrain medium for construction of the leachate collection system would be by approximately 20 barge deliveries to Deer Island. Traffic impacts associated with this alternative are judged to be modest.

For the chemical stabilization alternative, approximately nine to ten 80,000 lb (40 tons) gross weight trucks per week would be required over a 10 to 15 month period for the delivery of Portland cement and silica. Due to load restrictions of 33 tons for the MBTA bridge at Saratoga Street, the frequency of truck delivery would need to be increased to about 12 to 15 trucks per week. If two processing units were used for chemical treatment of the grit and screenings, thereby supporting a six to eight month treatment period, truck delivery of chemical reagents would be doubled to about 24 to 30 trucks per week. Traffic impacts associated with the chemical stabilization alternative are, therefore, judged to be more significant than for the secure landfill alternative.

Noise

The grit and screenings hauling and placement operations are similar for both grit and screening alternatives. However, for the chemical stabilization alternative, the material is shredded and stabilized with Chemfix before being landfilled. The additional noise of the shredder is therefore included. The sound level expected at the nearest neighbor for this operation with the shredder is 54 dBA. A construction activity, such as the shredder, that has the potential for causing a noise impact on the nearby community, will be limited to daytime shifts. In order to make the shredder noise more compatible with the daytime ambient sound level of 45 dBA at the nearest neighbor, the shredder will require a partial enclosure blocking sound propagation to the north. The shredder enclosure will reduce the total noise from this activity to approximately 44 dBA. The level of noise control required for this alternative is therefore rated as moderate.

The secure landfill alternative for the disposal of the grit and screenings places the material in a lined, secure landfill to be covered with a landform. The sound level expected from this operation was predicted based on the equipment to be used. Sound level estimates of construction noise were made using the methodology in the ESEERCO Power Plant Construction Noise Guide (Ref. 1). It was assumed that all equipment was operating all of the time during an 8 hour-per-day shift, and the percentage of time at full load was as recommended in the ESEERCO Guide.

The sound level estimate assumes hemispherical radiation and atmospheric absorption, per the Screenings Report (Ref. 2). No barriers were assumed, although the existing central drumlin forms an effective barrier for noise propagating northward. Noise propagation WNW toward he western edge of Point Shirley is relatively unimpeded. The estimated sound level for this activity is 41 dBA for the energy average level (Leq) at the nearest neighbor on Tafts Avenue, Point Shirley. This estimated level will occur during ideal noise propagating conditions. Often there will be additional attenuation due to adsorption by the ground, wind shadows, and temperature and humidity conditions other than those of the conservative design conditions. The noise control engineering effort for this alternative is rated as minimal..

Section 7.4 References

1. Empire State Electric Energy Research Corp., May 1977. Power Plant Construction Noise Guide.

2. Massachusetts Water Resources Authority, Dec. 1976. Report on Evaluation and Screening of Unit Processes, FJ36A, Secondary Treatment Facilities Plan.

7.5 INSTITUTIONAL CONSIDERATIONS

The purpose of this section is to evaluate the early site preparation activities according to institutional criteria agreed upon previously by the MWRA Board of Directors. For this analysis, early site preparation is defined as those activities which can be initiated on Deer Island in the immediate future to ready the site for future construction activities. Alternatives exist only for completing the relocation of grit and screenings as part of early site preparation.

Timely Implementation

Chemical stabilization is a more time-consuming process than the secure landfill alternative, perhaps requiring a few additional months. Because the stabilization process will only be conducted during the winter months to mitigate odors, it is possible that the additional time requirement may extend the process into a second winter season. For this reason, chemical stabilization is rated as "difficult." There is greater certainty that the secure landfill disposal can be completed in one winter. This alternative, therefore, is rated as "modest."

Permitting

Both alternatives are rated as "modest" as neither one is expected to involve obtaining complex or lengthy permits. The secure landfill alternative, however, will require a Corps of Engineers permit under Section 10 of the River and Harbors Act of 1889 to support the off loading of sand from barges required for construction of the secure landfill underdrain system.

External Coordination

Both alternatives are rated "moderate" in the amount of coordination required. Both alternatives require working closely with DEQE. Coordination also is needed between MWRA and the Town of Winthrop to mitigate any related impacts.

Internal Coordination

Both alternatives will require an "extensive" degree of coordination with other Authority projects including: daily operations; the fast-track plant upgrading projects; the pilot program for composting; pier construction; interim sludge disposal; the alternative disinfection project; and others. The movement of material will be taking place in approximately the same area as other projects, thereby generating a strong need for careful, integrated planning to avoid conflict and congestion.

Demand For Unique Or Scarce Construction Resources

Neither alternative has unique requirements.

Flexibility To Meet Project Phasing

Both alternatives are rated "good" in their ability to be modified to facilitate phasing of the primary or secondary plant with the goal of expediting the construction schedule.

7.6 TECHNICAL EVALUATION OF ALTERNATIVES

The purpose of this seciton is to evaluate the early site preparation alternatives for disposal of existing grit and screenings on the basis of the technical criteria.

Area Requirements

Under both alternatives the grit and screenings will be incorporated into an on-site landform located at the southern end of the island. The acreage requirement for both alternatives is 5 acres.

Reliability/Flexibiity

Neither of the disposal alternatives precludes the feasibility of engineering or construction options. Stabilized or unstabilized waste can be placed within the landforms given the shape and elevation that are planned.

Constructibility

The constructibility aspects of the 2 alternatives are somewhat different. The placement of the stabilized waste will be easier to accomplish. The unstabilized waste will require intermediate layers of soil to improve strength characteristics, to provide a suitable working surface for succeeding layers, and to reduce odor. However, the stabilization process will result in a longer construction schedule unless the treatment capacity is increased appreciably. The stabilized alternative is rated as presenting "minimal" waste conditions for construction. The secure landfill is rated as presenting "modest" conditions for construction.

Power Needs

There are no requirements for interim or permanent on-site power for either alternative. Although the stabilization process will require more power than the secure landfill alternative, this power will be supplied by the contractor and will not place demands on the existing power supply at Deer Island.

7.7 COORDINATION REQUIREMENTS

During the early site preparation period, other ongoing construction activities (i.e. fast track improvements, etc. and the existing island service activities), existing primary treatment, prison operations, etc. may affect the progress of early site preparation work

should these activities not be properly coordinated, managed and controlled. Furthermore, new construction activities, (i.e. piers, interim residuals facilities, etc.), which will occur concurrently with early site preparation activities may also affect progress. Thus, in order to reduce the possibility of interruptions and delays, construction planning and scheduling must include all on-island construction contract work and services.

The activities that will occur on-island during the 1988-1990 time frame are listed below and will be added to the master schedule network.

A - On going Work Activities

- o Fast track improvements
- o Operation of existing primary treatment facilities
- o Operation of prison facilities (until at least 1989)

B - New Work Activities

- o Interim Sludge
- o Construction of the on-island piers
- o Construction of the interim scum facilities
- o Grit and screenings removal and reburial
- o Temporary utilities installation
- o Relocation of underwater cable to Deer Island Light
- o Provision of alternate service water system
- o Protection of existing outfall
- o Demolition and removal of Fort Dawes and reservior
- o Excavation of central drumlin and landform development
- o Relocation of access facilities

These activities will be planned and scheduled by successor constraints in the project master construction schedule network plan, and will require daily monitoring to insure that all design requirements and MWRA mitigation commitments are fully accomplished.

7.8 SELECTION OF RECOMMENDED PLAN

Table 7.8-1 summarizes the results of the criteria analysis of the alternative grit and screenings disposal methods. The secure landfill method of disposing of the existing grit and screenings has been selected for implementation during early site preparation. This disposal method, combined with an implementation schedule predicated on the prison being decommissioned in 1989, creates the most favorable early site preparation work plan. Under this plan, the environmental impacts to Deer Island, the Town of Winthrop, and the prison, are minimized and certain mitigation and relocation costs associated with the prison are avoided.

TABLE 7.8-1
CRITERIA ANALYSIS OF ALTERNATIVES

RELOCATION OF GRIT AND SCREENINGS

Criteria Environmental	Chemical Stabilization	Secure Landfill
Air Emission Control	Minimal	Minimal
Noise Control	Modest	Minimal
Environmental Criteria	Minimal	Minimal
Traffic	800 Truck Trips (Round Trips)	20 Truck Trips (Round Trips) 20 Barge Trips
Technical		
Area Requirements	5 acres	5 acres
Flexibility	High	High
Constructibility	Minimal	Modest
Power Needs	None	None
Institutional		
Timely Implementation	Difficult	Modest
Permitting	Modest	Modest
External Coordination	Modest	Modest
Internal Coordination	Extensive	Extensive
Demand for Unique Resources	None	None
Flexibility to Meet Project Phasing	Good	Good
Cost		
Present Worth Costs	$8.7 Million	$4.8 Million
Capital Costs	$6.5 Million	$3.6 Million

Section 8

8.0 RECOMMENDED PLAN

8.1 DESCRIPTION OF RECOMMENDED PLAN

The recommended plan for early site preparation consists of the completion of those activities and alternatives described herein that will best insure that the site is available for the start of primary treatment plant construction in early 1991.

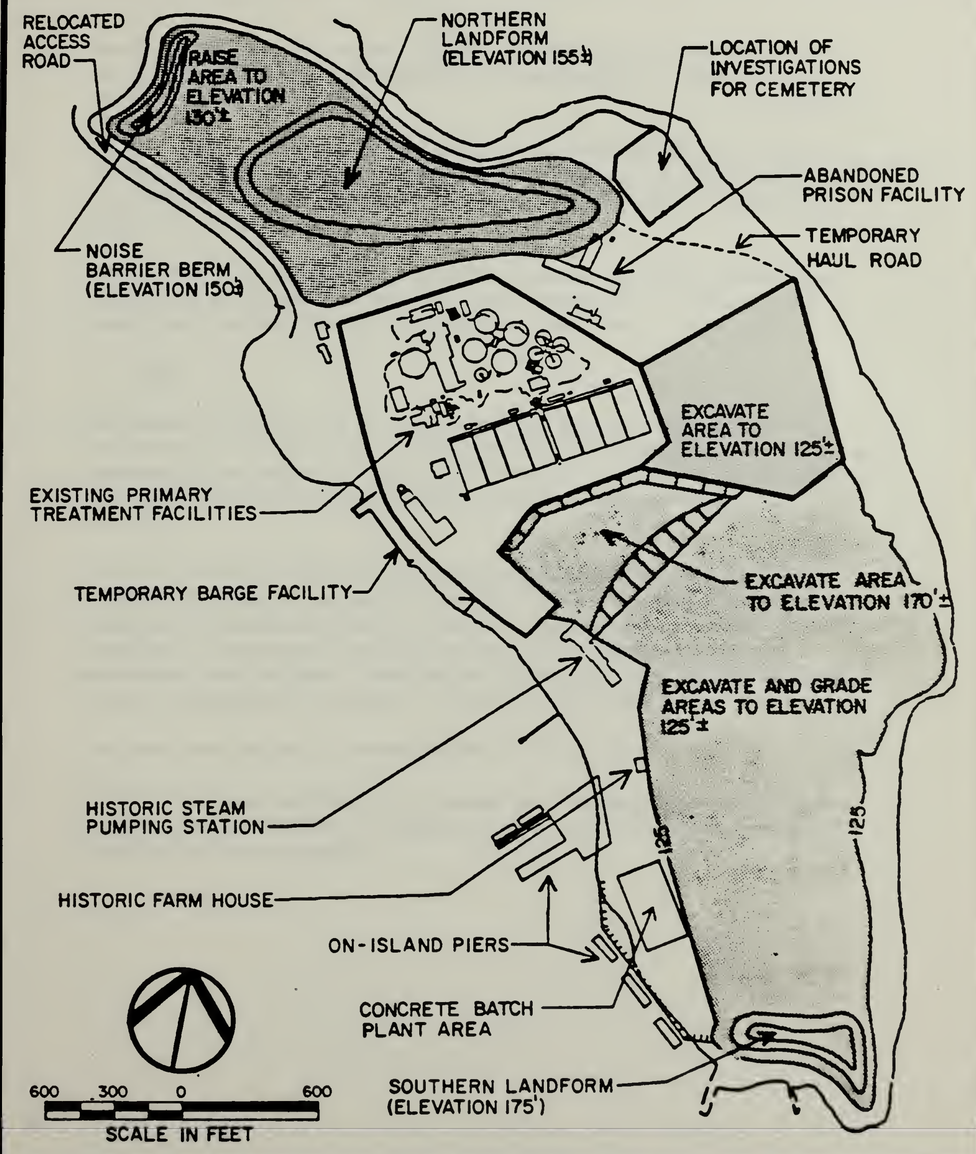
The first early site preparation activity required to be accomplished is the installation of any necessary additional protection for the several existing outfall pipes buried along the west side of Deer Island between the plant and the harbor. Without support or load transfer modifications, repeated heavy construction loads and/or additional loads due to proposed landform construction over the pipes near the southern end of the island will subject the pipes to stresses that may exceed the allowable limits. Identification of the sources and magnitudes of the additional loads early on in the design phase of the project is critical to allowing the design of any required modifications to proceed.

Removal, transport and disposal of the existing 85,000 yd^3 of grit and screenings is another activity that requires a very early start. The process involves the development of a new landfill south of the existing grit and screenings waste areas followed by excavation and disposal of the waste. In order to mitigate odors associated with the transfer process, the activity will be limited to the cooler months of the year.

Since only two colder weather construction periods will be available (1988-89 and 1989-90) to complete the transfer of this waste prior to the start of the new primary plant construction, early planning, design and contract award are essential. Two on-site alternatives were evaluated for grit and screening disposal: 1) transfer of untreated waste to a secure landfill; or (2) chemical stabilization of the waste by the Chemfix process. While both alternatives are feasible, the disposal by the secure landfill concept is the recommended alternative since it can be accomplished in a shorter time, at a lower cost, and with less environmental impact than the chemical stabilization process.

Removal of a portion of the central drumlin is also an essential part of the recommended early site preparation plan. Not only is the excavation of over 1.6 million yd^3 required to establish the elevation 125 ft grade for construction of the primary treatment plant, but drumlin soils are to be used in landform creation and as stabilizing and cover material for the grit and screenings area.

An institutional constraint to the efficient excavation of the drumlin and the creation of the optional landforms at the northern end of the island is the presence of the Deer Island prison. The recommended plan is to have all of the prison land available by 1989 for placement of soils. Figure 8.1-1 illustrates the extent of the site preparation and landform creation. If only the prison recreational area is available in 1989-90, the creation of permanent visual and



MASSACHUSETTS WATER RESOURCES AUTHORITY

FIGURE 8.1-1
DECOMMISSIONED PRISON

noise landform barriers at the northern end of the island will have to be undertaken in two phases. During the early site preparation period, only that portion of the northern landform shown in Figure 8.1-2 will be built.

The decommissioning and removal of the cooling water reservoir built into the top of the drumlin must be accomplished before the early site preparation phase of drumlin excavation can be completed. The recommended plan includes the provision of an alternate cooling system back-up to the primary service water system.

Other activities to be completed during the early site preparation period are relocation of the existing island access facilities (including the roadway, parking lot, the security station and fencing) and the preparation of the area for the concrete batch plant.

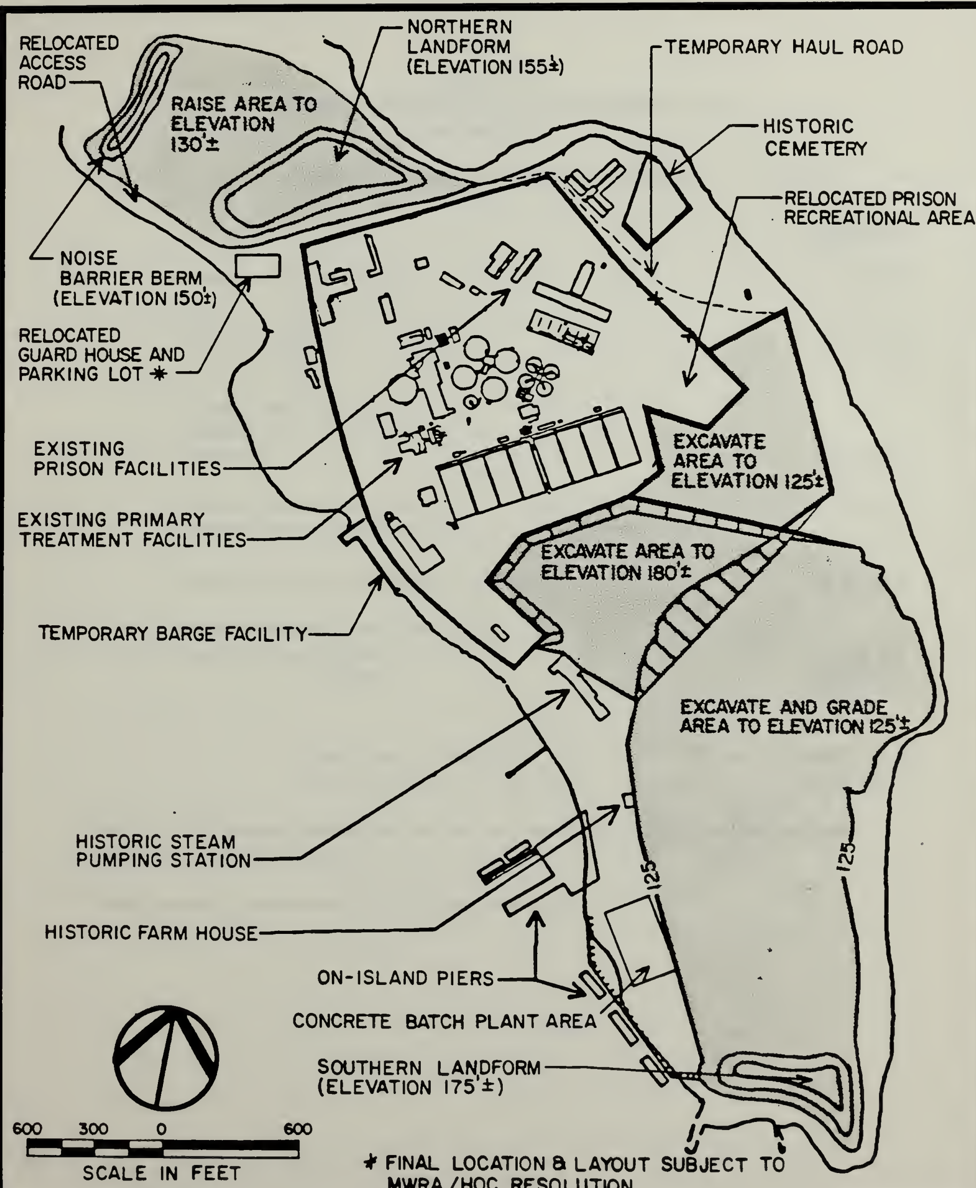
8.2 COSTS

The estimated costs for early site preparation (1988-1990) have been developed for the recommended plan. Under this plan, the prison facility will be decommissioned by 1989 with the associated land areas available for landform construction. The recommended plan also includes the disposal of the existing grit and screenings in a secure landfill at the southern tip of Deer Island.

Table 8.2-1 contains a summary of the costs for each of the major activities required to be completed during early site preparation. As shown in Table 8.2-1, to obtain project costs, capital costs are increased by a factor of 35 percent to account for engineering and contingencies. Since the early site preparation activities are of relatively short duration and occur very near the project - defined base year of 1990, the present worth cost is assumed equal to the project cost (i.e. the present worth factor has been assumed to be 1.0).

The present worth cost for the recommended plan is $ 17.4 million.

Should only the prison recreational area be available during this phase of the overall project, the present worth cost would be 15.8 million since nearly one-half million cubic yards less of excavation could be accomplished.



MASSACHUSETTS WATER RESOURCES AUTHORITY	FIGURE 8.1-2 EARLY SITE PREPARATION FOR DEER ISLAND OPERATING PRISON - ONLY RECREATIONAL AREA AVAILABLE UNTIL 1992

TABLE 8.2-1
Early Site Preparation Costs for Recommended Plan
Schedule Plan 1

(Prison Decommissioned/Total Area Available)

Item	Capital Cost*
Protection Existing Outfall	$ 450.000
Dispose of Grit and Screenings in Secure Landfill	$3.628.000
Demolish and Remove Fort Dawes Facilities and Cooling Water Reservoir	$2,670,000
Relocate Deer Island Access Road. Security Fencing, Guardhouse	$ 175,000
Excavate Drumlin and Develop Landform**	$4.875.000
Provide Alternate Service Water System Source for Existing Plant	$1.100.000
TOTAL =	$12.898.000

Project Cost = Capital Cost X 1.35	=	$17.412.000
Present Worth Cost = Project Cost	=	$17.412.000

*Based on 4330 baseline Construction Cost Index as presented in the Engineering News Record (ENR-CCI) for September, 1986.

**Total quantity of soils excavated is 1.6 million cubic yards

TABLE 8.2-2
Early Site Preparation Costs for Initial Phase of Recommended Plan
Schedule Plan 2

(Operating Prison/Only Recreation Area Available)

Item	Capital Cost*
Protect Existing Outfall	$ 450,000
Dispose of Grit and Screenings in Secure Landfill	$3,628,000
Demolish and Remove Fort Dawes Facilities and Cooling Water Reservoir	$2,670,000
Relocate Deer Island Access Road, Security Fencing, Parking Lot and Guardhouse	220,000
Excavate Drumlin and Develop Landform*	$3,525,000
Relocate Prison Recreation Area	100,000
Provide Alternate Service Water System Source for Existing Plant	$1,100,000
TOTAL =	$11,693,000

Project Cost = Capital Cost X 1.35	=	$15,786,000
Present Worth Cost = Project Cost	=	$15,786,000

*Based on 4330 baseline Construction Cost Index as presented in the Engineering News Record (ENR-CCI) for September, 1986.

**Total quantity of soils excavated is 1.2 million cubic yards.

8.3 ENVIRONMENTAL IMPACT ASSESSMENT

Section 8.1 describes the recommended plan for early site preparation activities which will be implemented during the period between 1988 and the end of 1990. The early site preparation activities to be conducted on Deer Island will consist of the following:

- o Protection of the existing primary treatment facility outfall pipes.
- o Excavation of approximately 85,000 yd^3 of grit and screenings, and disposal of this material in a secure landfill constructed at the southern tip of Deer Island.
- o Removal of the existing three million gallon effluent reservoir located at the top of the central drumlin.
- o Provision of back-up service water system.
- o Excavation of the southern portion of the central drumlin to an elevation of 125 ft and construction of landforms at the northern and southern ends of Deer Island.
- o Relocation of island access facilities.

The following sections provide an assessment of the impacts of the above early site preparation activities on the affected land and marine resources.

8.3.1 GROUNDWATER

As part of the development of an interim closure design plan for the grit and screenings disposal areas (CDM, 1986), the horizontal and vertical extent of the disposed materials as well as existing groundwater quality were evaluated. The results of this study indicated that for all four of the existing disposal areas, at least a portion of the waste materials are located within the groundwater. Four groundwater monitoring wells installed adjacent to the disposal areas were monitored for pH, temperature, volatile organics, priority pollutant metals, total PCB's, base neutral extractables, total petroleum hydrocarbons, and an anion scan. The results of the groundwater monitoring indicated that the groundwater quality at these locations was not adversely affected.

Early site preparation activities will provide for isolation of the grit and screenings from the groundwater, and subsequent containment of the waste within a secure landfill designed in accordance with the DEQE, sludge-only guidance criteria. This long-term protection of the groundwater will have a beneficial impact on the ground water quality by removing a potential source for contamination.

Excavation of the southern portion of the central drumlin will result in the removal of perched groundwater which has been observed near the crest of the drumlin. The loss of this limited groundwater resource will not affect any present, or potential future groundwater use plans.

8.3.2 AIR QUALITY

The excavation of the grit and screenings disposal areas will have the potential to create odors which will be detectable in the vicinity of the construction areas. No odor nuisance problems are anticipated, however, outside of the immediate construction area, since:

- Excavation and landfilling will be performed only during the cooler months (November - April). During the sampling of the disposal areas, described in Section 7.4, it was observed that odors from the sampling trench were minimized during the coolest time of the day, when air temperature was approximately 50° F.

- The landfilling activities will minimize the surface area, and frequency of exposure of the grit and screenings to the air, by compacting the filled grit and screening to one-foot-thick layers, and providing a six-inch-thick layer of soil over each layer.

Fugitive dust from soil excavation and filling activities will be controlled as required by the use of sprinkling trucks or other such techniques.

8.3.3 LAND USE AND VISUAL AESTHETICS

Potential for Joint Use Opportunities

Construction of the landforms at the northern end of Deer Island under the Recommended Plan will not affect the potential for creating future public recreational/passive use opportunities at this location. The construction could, however, displace an existing recreation area used by the House of Correction. To mitigate this impact if the prison is still operating, a new recreation area for the use of the House of Correction could be made available adjacent to the Hill Prison. Recommended plans for reuse of this area will be provided in Volume III, Treatment Plant.

Construction of the southern landform, which will provide for an additional 20 ft of soil on top of the secure landfill for the grit and screenings, will not affect either existing recreational opportunities or the potential for creating future recreational opportunities on Deer Island.

Visual Resources

Early site preparation activities on Deer Island will require removal of the southern portion of the central drumlin and the use of drumlin soils in the northern and southern portions of the island to create landforms. While the removal of existing landforms will change the existing visual character of the island as seen from viewing locations throughout the region during the early site preparation period, the new landforms will serve to block views of some of the site preparation activities, and ultimately the plant and its construction, from the more sensitive areas: the Point Shirley neighborhood of Winthrop and the Harbor islands.

A temporary haul road will also be constructed along the eastern side of the island as shown in Figure 8.1-1. While the movement of construction equipment and vehicles along the haul road are likely to be visible from viewing locations on the water to the northeast of Deer Island preference, will be given, wherever possible, to siting the road so as to minimize the visibility. Any visual impacts from the road will, however, be temporary as the construction of berms in later stages of construction will likely require its relocation to a more interior portion of the site.

8.3.4 TRAFFIC

Traffic impacts associated with the early site preparation activities in 1988-1990 will result in a modest increase in vehicle traffic over existing conditions. Present activities on Deer Island include traffic related to the operation of the existing wastewater treatment plant, fast track improvements at the plant, and the Deer Island House of Correction. In addition, beginning in late 1988, traffic from the construction of the on-island transportation facility (piers) will be included in the daily flow of traffic.

During the approximate three year period for early site preparation activities beginning in 1988, existing traffic will consist of worker vehicle and truck trips associated with the treatment plant operation, fast track improvements construction, and House of Correction operations as shown in Table 8.3.4-1 (MWRA, 1985).

Vehicle trips associated with the existing treatment plant will average between 60 and 65 round trips per day, representing approximately 93 workers. In accordance with shift times at the treatment plant, many of these trips will occur during the off-peak hours. Truck trips to the treatment facility are expected to average between 12 and 14 round trips distributed over the course of the day.

Vehicle trips associated with the activities at the House of Correction are estimated at 114 round trips per day. These trips are further distributed in accordance with normal shift changes, and generally occur in non-rush hour times.

Fast track improvements including the rehabilitation of digesters, thickeners, and chlorination systems, and the improvement of power distribution, pumps and power buildings have resulted in daily vehicle traffic averaging 34 to 50 vehicles (round trips) per day. During peak construction periods, 60 to 90 vehicle round trips are estimated for workers. In accordance with construction schedules, many of these trips occur during the pre-rush hour periods in the morning and afternoon. Average truck traffic as the result of fast track improvements is estimated to be 4 to 6 round trips on a daily basis (Havens and Emerson, 1987). During peak construction times, truck trips are expected to reach a level of 10 to 15 per day. Under the present schedule, all fast track improvements will be completed by December 1989 (Havens and Emerson, 1984).

Construction of the on-island pier facility, which is scheduled to be completed in late 1989, will require an average of 60 (100 peak) vehicle round trips per day and 4 (12 peak) truck round trips per day. Heavy equipment including trucks, front end loaders, bulldozers, and backhoes will be delivered and remain on-site for the duration of the project. Given the

TABLE 8.3.4-1
TRAFFIC LEVELS DURING EARLY SITE PREPARATION PERIOD

Facility or Project	Average Daily Traffic (round trips)
Early Site Preparation (1988 to late 1990)	**70 vehicles/day; 2-3 trucks/day*; 20 barge trips**
Existing Deer Island Treatment Plant (entire period)	60-65 vehicles/day; 12-14 trucks/day
Deer Island House of Correction (until early 1989 Decommissioning)	114 vehicles/day
Fast Track Improvements (until Dec. 1989)	34-50 (60-90 peak); 4-6 trucks/day (10-15 peak).*
Pier Construction (late 1988 to late 1989)	60 vehicles/day (100 peak); 4 (12 peak) trucks/day*
Total Without Early Site Preparation Traffic	268-329 vehicles/day; 20-32 trucks/day
Total With Early Site Preparation Traffic	338-399 vehicles/day; 22-35 trucks/day

*During periods for concrete placement, 15 concrete supply trucks may be expected.

construction schedule for development of the piers, most of the traffic will occur during the off-peak hours in Winthrop (C.E. Maguire, 1987).

In addition to the four traffic impacts described above, additional traffic from the early site preparation activities will occur between 1988 and late 1990. The outfall protection and grit and screenings disposal activities will take place sequentially and will use somewhat the same workforce and equipment. For these tasks, approximately 20 personnel will be required. The anticipated equipment will consist of 8-10 trucks, 2-3 bulldozers, 2-3 front end loaders and 2 backhoes. As with the other construction projects, this equipment will be delivered to the site where it will remain for the duration of the project. The delivery of bentonite will require 1 to 2 truck round trips per day for 3 weeks; delivery of the polyethylene membrane will require 1 or 2 round trips. The 17,000 yd^3 of sand required for the sand filter will be provided using delivery by barge (20 loads). The necessary pipe and pumps associated with the leachate collection system will be transported by truck to the site in 2-3 truck round trips.

Removal of the cooling water reservoir and drumlin excavation will require approximately 50 workers per day. The required equipment may consist of approximately 2-3 bulldozers, 2 front-end loaders, 2 scrapers, 1 grader, 2 haulers, 2 cranes, and 10 trucks. Earth moving activities involving the on-site redistribution of approximately 1.6 million yd^3 of soil from the central drumlin will require a minimal (2-3) number of off-site service vehicle round trips per day to support the on-site equipment fleet.

With the prison facility abandoned in 1989, the maximum number of vehicle round trips per day (350-450) to the site will occur only over a several month period in late 1988. During most of 1989 the number of vehicle trips per day will decrease to 250-350. By 1990 the traffic will be further reduced, by completion of the fast track improvements and the pier construction, to 150-250 vehicles per day. Of this total impact, the isolated effect of early site preparation traffic is approximately 70 vehicles per day.

With respect to truck traffic only, the effects of early site preparation results in only 2-3 round trips per day (except for occasional periods of concrete placement when up to 15 additional delivery trucks are required). The combined effect of all island activities will result in 22-35 truck round trips per day.

8.3.5 NOISE

This section discusses the community sound levels expected as a result of the recommended plan at the nearest residences to Deer Island, i.e. those on Tafts Avenue on Point Shirley. The noise sources of concern are the construction of the existing treatment plant outfall protection, the removal and placement in landforms of a portion of the central drumlin, and the construction of a secure landfill for the existing grit and screenings. Each of these sources, as well as the combined sound level for the activities, will be discussed individually.

Outfall Pipe Protection

The building of landforms on the south end of Deer Island may require the construction of a protective barrier over the existing treatment plant outfall to protect it from the additional load. This activity will include excavating to the existing outfall pipe, driving sheet piling on either side, and capping with concrete. The sound levels expected from this activity were calculated at the nearest neighbor assuming no barrier attenuation. The equipment assumed in the calculation are backhoes, a front end loader, pile driver, compressor, mobile crane, and bulldozers.

Sound level estimates of construction noise were made using the methodology in the ESEERCO Power Plant Construction Noise Guide (ESEERCO, 1977). It was assumed that the equipment was operating all of the time and the percentage of time at full load is as recommended in the ESEERCO Guide.

The sound level estimate assumes hemispherical radiation and atmospheric absorption as per the Screenings Report. (CDM, 1986). No barriers were assumed although the existing drumlin forms an effective barrier for noise propagating northward. Noise propagation to the WNW is relatively unimpeded.

The estimated sound level for this activity is 41 dBA for the energy average level (Leq). Peak levels for pile driving noise are expected to be approximately 55 dBA, which can be reduced to 45 dBA with a shroud over the hammer (CERL, 1981).

These estimated levels will occur during ideal noise propagation conditions. Often there will be additional attenuation due to absorption by the ground, wind shadows, and additional atmospheric absorption from temperature and humidity conditions other than those of the conservative design conditions. The noise control engineering effort for this alternative is rated as minimal.

Drumlin Removal and Landform Creation

The southern section of the central drumlin will be excavated and moved to allow room for primary plant construction. Most of the drumlin material will be trucked around the east edge of the island for landform creation in the prison area since this recommended plan assumes the decommissioning of the prison by 1989.

Portions of the excavated material will also be deposited throughout the narrow northern end of the island to relocate the island access road and raise the elevation to 130 feet and to construct a narrow noise barrier berm at the extreme northern end of the island to elevation 150 ft to provide additional noise attenuation. The dominant sources of noise from this activity will be the trucks delivering the drumlin material, the bulldozers and scrapers used to shape the landforms, and the compactors to be used on the north end of Deer Island. The expected sound level for construction of the noise berm will initially be 61 dBA at Tafts

Avenue on Point Shirley. Special quiet wheeled bulldozers will be used, supplemented by a mobile crane. In addition, trucks will stay well back from the noise berm until they are ready to dump their loads. As soon as the berm begins to take shape, the crane and trucks will stay behind the barrier as much as possible so that only the quiet dozer will be in the open. With this operation the community sound level will drop to 51 dBA. Without this special operation, or the quiet dozer, the community sound level due to activity would be 66 dBA. Construction of this noise barrier will take approximately one month. Thereafter, landfilling construction activities required to complete the raised, northern platform area will generate an estimated noise level of 51 to 57 dBA at Point Shirley.

Construction of the higher northern landform will not be shielded by the noise berm but will result in noise levels of 57 dBA or less due to the distance from the community. A total of 350 days will be required for this landform construction at the northern end.

For the costing plan, it is assumed that for any alternative in which the prison is still occupied, it will be necessary to modify the northern area where fill from the central drumlin is placed, relative to the recommended plan. The security fence to the north of the prison will be the southern limit of any landfilling; therefore, the northern landform must be placed on top of the southern part of the raised platform at 130 ft elevation. The access road from Point Shirley to the island will be relocated to the western shore of the neck. A noise berm will be built as in the recommended plans using quiet wheeled dozers to shield the community from subsequent activities on the raised platform.

At Point Shirley the energy average sound level (Leq) due to construction of the noise berm and excavation of the drumlin will be 61 dBA or less. This exposure will occur for about one month. The sound level will generally be below 54 dBA during construction of the platform, rising above this for brief periods when activity is near the western edge of the platform. The sound level will rise again to 57 dBA when the landform is being built on top of the platform.

At the prison, the sound level resulting from the combined activities of drumlin removal and construction of the northern landform will be 61 dBA. This sound level will gradually rise to 83 dBA as the activity comes within 100 feet of the security fence.

A lesser amount of material will be moved south to increase the elevation of the southern portion of the island to 125 feet and to create a higher landform to elevation 175 ft at the far southern end. The expected sound level at Point Shirley for this recommended plan activity will be approximately 49 dBA assuming that no northern landforms are yet in place.

Secure Landfill Construction Platform

The grit and screenings will be disposed of by placement in a lined, secure landfill to be covered with a landform. The sound level expected from this operation was predicted based on the equipment to be used, consisting of backhoes, a scraper, dozers, a compaction roller, five trucks, a grader and a mobile shovel. No barriers were assumed, although the existing central

drumlin forms an effective barrier for noise propagating northward. Noise propagation WNW toward the western edge of Point Shirley is relatively unimpeded. The estimated sound level for this activity is 47 dBA for the energy average level (Leq) at the nearest neighbor on Tafts Avenue, Point Shirley.

Total Sound Levels (Point Shirley)

As indicated in the analysis above, the sound level expected at the nearest residence for the task of securing the landfill is 47 dBA. The outfall protection task will give a sound level of 39 dBA for most of the operation with peak levels of 45 dBA for the pile driving operation. The sound level expected for moving the southern end of the central drumlin is 49 dBA.

At the nearest residence, the sound level expected for moving half of the central drumlin, primarily to the northern end of the island, will briefly be 60 dBA. This sound level will drop to 54 to 52 dBA for the rest of this activity. The evaluation criterion which was established for determining noise impacts was determined to be 45 dBA for day time (CDM, 1986). Massachusetts DEQE regulations, however, allow noise levels to be 10 dBA above ambient levels, or 55 dBA.

Sound Levels At Deer Island House Of Correction

Consideration has been given to the potential for implementing noise mitigative measures for the House of Correction area, in the event that this area is not vacated by 1989, and assuming that the existing prison recreational area is moved to a new location southeast of the Hill Prison. For this phased implementation of the recommended plan, described in section 7.1, predicted noise levels resulting from earth moving activities range from approximately 75 to 89 dBA within the prison security-fenced yard, and approximately 60 to 70 dBA inside the Hill Prison and the Administration Building (assuming opened windows).

One of the mitigative measures which was considered consisted of erecting an approximately 2,700-ft-long, 32-ft-high wall along the outside of the security fence and enclosing the area from the Administration Building to the relocated recreational area. For estimating purposes, this noise barrier was assumed to be constructed of 3/4-in-thick treated plywood, supported by steel columns. The noise barrier wall was determined to be effective in reducing noise from adjacent earth moving activities to approximately 60 to 70 dBA within the fenced prison yard at existing yard grade. However, during placement and grading of the upper 20 feet of the northern landform, the noise barrier will attenuate earth moving noise only for the first two floors of the Hill Prison. The upper floors of the Hill Prison would be above the line-of-sight from noise-producing activities on the northern landform, and thus would not receive noise control. The estimated cost for this mitigative noise barrier, including the cost for its demolition following the vacating of the prison, was $1,038,000.

Implementation of the 2,700 ft long noise barrier wall for the prison area is not recommended for the following reasons:

- Earth moving activities during early site preparation will be performed only during one daytime shift. The earth moving activities will therefore not affect sleeping hours.

- The noise barrier wall will not control earth moving noise above the second floor of the prison. Effective noise control for upper floors of the prison would require a 20-ft-higher barrier wall having a different wall construction. The cost for this temporary control would be more than double the estimated project cost for the 32-ft-high wall.

8.3.6 TERRESTRIAL ECOLOGY

Construction activities associated with early site preparation activities will result in impacts to the local terrestrial, and in some cases, aquatic ecosystems. Sources of potential impact to fauna and flora associated with construction include: 1) habitat removal and the subsequent displacement of fauna from cleared areas; 2) the generation of fugitive dust; 3) increased potential for erosion of cleared surfaces; 4) construction generated noise; and 5) the movement of construction personnel, equipment and materials onsite. Each of the above impacts have been assessed for each of the early site preparation activities.

<u>Habitat Removal and Displacement of Fauna</u>

Disposal of Grit and Screenings

The recommended plan for the disposal of grit and screenings involves excavating the existing disposal sites and redepositing these materials in a secure landfill at the southern portion of the island, as detailed in section 8.1. In terms of habitat removal, the impact of this alternative is expected to be minimal. The existing disposal sites presently contain either no vegetation due to recent soil landfilling operations, or contain grasses. The approximately five acre area proposed for the new landfill is presently occupied by abandoned structures, both military and non-military. Thus, the proposed landfill site presently contains no native biological communities with the exception of pioneer weed species and grasses. Utilization of this area for disposal of grit and screenings in an environmentally acceptable manner will have essentially no adverse impact in terms of habitat removal and displacement of fauna.

Removal of the Southern Portion of the Central Drumlin

Removal of the southern portion of the central drumlin will result in a loss of habitat consisting primarily of grasses and remnant woods (shrubs and brushy areas). The abandoned orchard on the southwest base of the drumlin will also be removed. Soils excavated from the central drumlin will be used to construct the landform at the southern end of the island, on top of the secure landfill used for grit and screenings disposal. Excavated soils will also be used to construct permanent landforms at the northern end of the island.

The loss of wooded habitat is expected to have an adverse impact on local wildlife species (birds and small mammals). Surveys of the site have indicated that the island's wooded

communities support a variety of faunal species. The presence of raptors such as the sparrow hawk further suggest ample prey in the form of small mammals and insects. A conservative estimate is that fauna (e.g. skunks, raccoons, squirrels and other rodents) displaced as a result of vegetation removal will be lost from the local population, either directly or indirectly through increased predation and stress. Given the "peninsula" nature of the island, the loss of wooded habitat and its faunal component, however small, should be considered significant. However, none of the faunal species are endangered, threatened or otherwise unique. All species are common elsewhere in the state and are generally compatible with man's activities such that repopulation of suitable areas on Deer Island by these species could be expected upon completion of construction activities. Thus, the loss of these individuals does not constitute an impact of consequence.

Protection of Existing Outfall Pipes

The existing outfall pipes from the Deer Island Plant may require protection from heavy equipment traffic and construction of the southern landform, as described in Section 8.1. It is anticipated that sheeting or piles will be driven and a concrete cap constructed to protect the effluent pipes. Habitat consisting of coarse grasses and pioneer forbs will be removed as a result of this activity. Since this habitat generally supports a limited number of bird and mammal species, the impact of its removal should be minimal.

Removal of Reservoir

The cooling reservoir situated at the top of the central drumlin contains 3,000,000 gallons of effluent used for service water. This reservoir will be drained and removed as part of the early site preparation. Since the reservoir contains no native biological communities, there will be no impact on terrestrial biota.

Generation of Fugitive Dust

Fugitive dust generated by heavy equipment and/or truck traffic during early site preparation has the potential for adverse effects on vegetation in areas adjacent to construction activities. Dust particles may clog leaf stomata, thereby reducing gas exchange necessary for photosynthesis and respiration. Airborn dust particles can also reduce photosynthesis through a process known as "shading" (i.e. limiting the amount of sunlight reaching the surfaces of green plants).

Fugitive dust onsite will be controlled by the use of water spray trucks or similar measures to dampen exposed surfaces. Thus, no adverse impact of dust on vegetation in adjacent communities is expected.

Increased Potential for Erosion

Surfaces which have been cleared, grubbed and graded will be more susceptible to erosion. Because of the quantities of earth which must be moved during early site preparation, a

construction mitigation program will be necessary at the Deer Island site to control erosion and prevent sedimentation into adjacent areas, particularly tidal wetlands. The construction mitigation program will ensure that runoff from exposed surfaces will drain to settling basins, holding ponds, hay bale barriers and/or silt fences, as appropriate, prior to discharge to the harbor. Temporary stabilization of graded areas will be accomplished by the use of seeding, tacking or mulching until permanent cover is established. Hay bales and drainage ditches will be used to prevent sedimentation into adjacent areas.

Construction Noise

Noise related to construction activities has the potential for disrupting behavior patterns of wildlife species inhabiting communities adjacent to the construction areas. Noise from heavy equipment, for example, may be sufficiently loud and intrusive to disrupt normal behavior patterns of birds and mammals through a phenomenon known as "masking" (i.e. interference with normal auditory or communication signals). However, since the areas surrounding the early site preparation construction zones presently do not support appreciable numbers of wildlife species, the effects of construction-related noise should be minimal.

Movement of Personnel, Equipment and Materials

Because of the quantity of earth moving and contouring which must be conducted during the early site preparation phase, the presence of numerous construction vehicles onsite would ordinarily have a deleterious effect on the wildlife inhabiting adjacent communities, primarily through roadkills, and the disruption caused by the movement of equipment, personnel and materials. However, since the areas adjacent to the construction zones presently do not support large numbers of faunal species, and existing impacts associated with ongoing construction activities for the fast-track and pier projects, no long-term deleterious impact is anticipated.

8.3.7 AQUATIC ECOLOGY

Barges delivering sand to Deer Island for construction of the secure grit and screenings landfill will require an off-loading area on the west side of the island. The temporary barge off-loading area will consist of two mooring dolphins and a crushed stone bed to permit docking and debarking at high tide. The temporary barge off-loading area will be located adjacent to the existing rock wharf, as shown in Figure 8.3.7-1 and 8.3.7-2.

The beaches on Deer Island are characterized by a mixture of coarse sand, cobble, large boulders used for rip rap and stone bulkheads (US EPA, 1976). Intertidal slopes are gradual except in areas where bulkheads have been installed. The area to be modified for sand barge off-loading is typical of bulkheaded areas on Deer Island. There is a a small stone beach adjacent to the existing wharf.

Approximately 6,000 square feet (i.e., 140 ft by 40 ft) of intertidal area will be modified by the placement of crushed stone. Some dredging would be required to grade the area in preparation for the crushed stone bedding. Approximately 50 to 75 cubic yards of material

would be removed using a clamshell dredge deployed from the top of the existing wharf. This material will be disposed of in the new, secure landfill at the southern tip of Deer Island. Dredging is not expected to have a deleterious effect on local populations of marine organisms. The limited amount of dredging required should not result in excessive turbidity in the area. Solid phase bioassay and bioaccumulation studies conducted on sediments from this area indicate that the materials are not toxic to aquatic biota (ERCO. 1986) and are suitable for offshore or upland disposal. Thus, any resuspension of the sediment and associated constituents should not have an injurious effect on fish, shellfish or benthic populations.

Approximately 0.1 acre of benthic habitat would be affected by dredging and placement of crushed stone. The benthic substrate in the intertidal area consists mostly of black silt. Taxonomic evaluation of these sediments revealed that the infaunal community is dominated by oligochaetes and polychaete worms, typical of Boston Harbor, as shown in Table 8.3.7-1. The loss of 0.1 acre of benthic habitat is not expected to be of any consequence.

8.3.8 HISTORICAL AND ARCHAEOLOGICAL RESOURCES

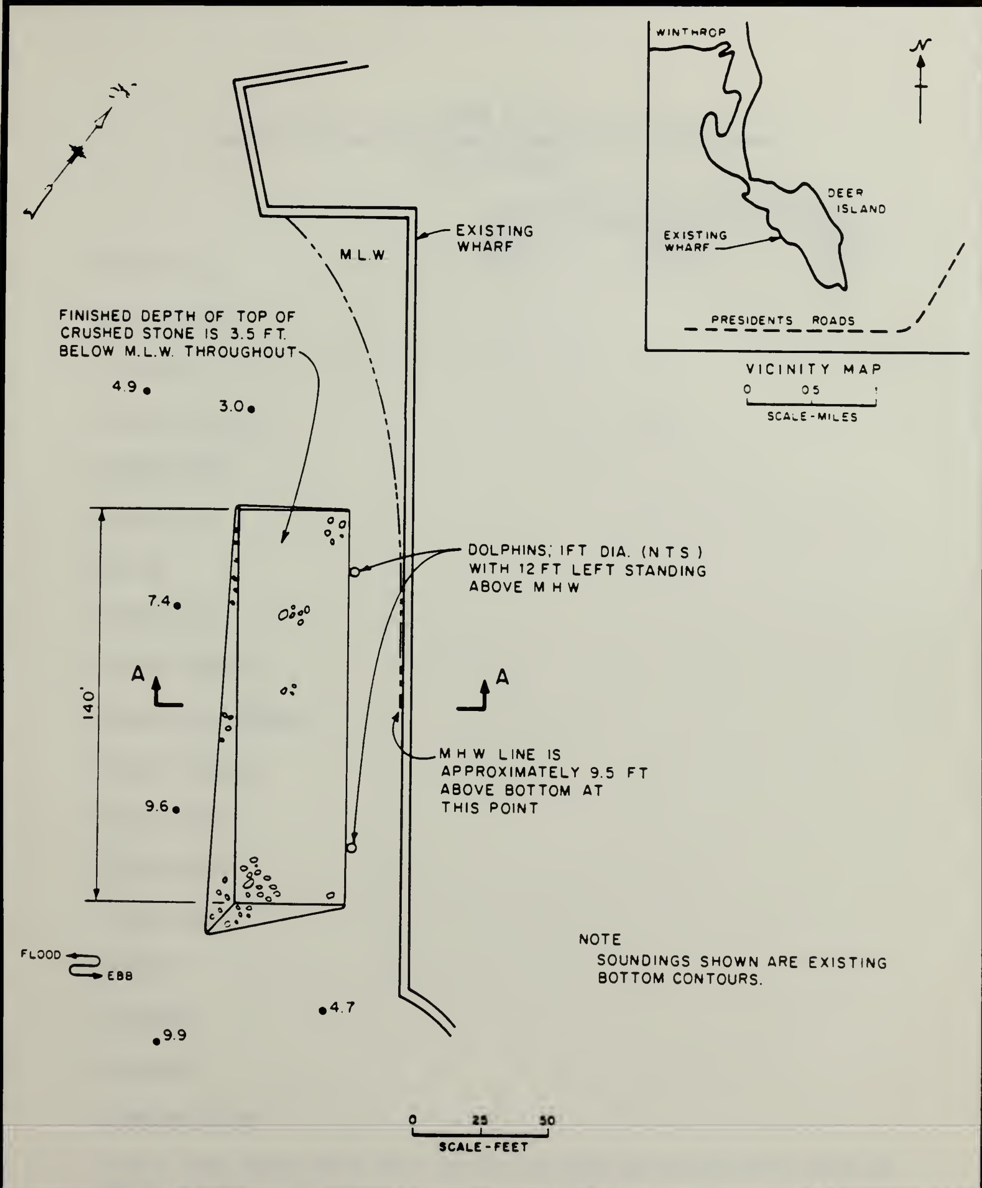
None of the construction activities planned for early site preparation will displace or directly affect any of the historical sites on Deer Island. Excavation of the southern portion of the central drumlin will be in proximity to the steam pumping station and the farmhouse. A temporary haul road, which will be used to move the excavated drumlin soils to the northern end of the island, may be close to the historic cemetery, located near the northeastern edge of Deer Island. Landforms at the northern end will be close to the prison superintendent's office.

Section 106 Review

As part of the EIS on-site selection for the secondary treatment facilities plant, Boston Affiliates conducted an historical survey of buildings on Deer Island in October 1985, on behalf of the MWRA. The survey was submitted to the Massachusetts Historical Commission (MHC) for its assessment of the historical significance of the identified buildings.

MHC reviewed the survey material and issued its findings on the properties in December 1985. It concluded that the Deer Island Pumping Station complex (pumping station and farmhouse) appeared to meet criteria for listing on the National Register of Historic Places. MHC also concluded that the prison complex as a whole did not meet National Register criteria because of demolition or substantial alteration of original buildings and the construction of numerous modern utility buildings. But it found that the Hill Prison and the Superintendent's Office were eligible.

In May 1987, Boston Affiliates conducted further research into the histories of the Superintendent's Office and the Farmhouse because the original survey had not located documentary evidence on these buildings. The Superintendent's Office was found to have been built in 1930 as a Doctor's House. The original construction date of the Farmhouse was not



MASSACHUSETTS WATER RESOURCES AUTHORITY

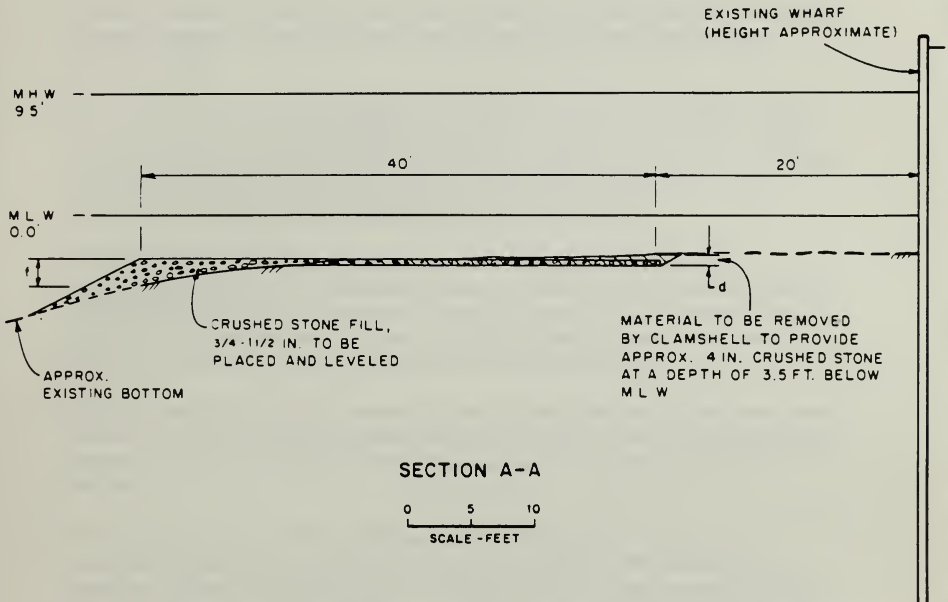
FIGURE 8.3.7-1
BARGE UNLOADING AREA - PLAN VIEW

Table 8.3.7-1
Results of Taxonomic Analysis of Sediment From Deer Island*
and Nut Island

Species name	Number of Organisms per Liter of Sediment Station DIN-5	Station DIS-1	Station DIS-6
Photis macrocoxa	1		
Oligochaeta	13	37	
Streblospio benedicti	3	20	
Capitella capitata	1		
Polydora ligni	1		
Spio sp.	1		
Nephtys caeca	1		
Botryllus schlosseri	b		
Campanularis gelatinuosa	b		
Nassarius trivitatus	2	2	1
Polydora socialis		1	
Diastylis sculpta		1	
Ampelisca abdita		2	
Mytilidae[a]			12
Cirratulidae			
Spio setosa			
Spiophanes bombyx			

*(ERCO, 1986). Stations DIN-5, DIS-1, and DIS-2 are located approximately 600 ft, 1200 ft and 2200 ft south of the temporary barge unloading area, respectively.

[a] All Mytilidae hinged but without meat.
[b] Present but in poor condition.



NOTES

1. DIMENSION d, MAXIMUM DEPTH OF DREDGED CUT, VARIES FROM 0 FT. AT SOUTH END OF UNLOADING AREA TO APPROX. 3 FT AT NORTH CORNER. APPROX. 50 TO 75 YD^3 DREDGED MATERIAL TO BE LANDFILLED ON DEER ISLAND.
2. DIMENSION f, MAXIMUM DEPTH OF CRUSHED STONE FILL, VARIES FROM 4 IN. AT NORTH CORNER TO APPROX. 4 FT AT SOUTH CORNER. TOTAL CRUSHED STONE FILL APPROX. 200 YD^3

MASSACHUSETTS WATER RESOURCES AUTHORITY	FIGURE 8.3.7-2 BARGE UNLOADING AREA - SECTION VIEW

found, but its use as storage, locker and residence and its history of alterations are now well documented.

Studies performed in 1986-1987 by the Public Archaeology Laboratory have indicated that the cemetery located to the east of the prison meets the age criterion for eligibility for the National Register.

Since historical and archaeological resources on Deer Island appear to be eligible for the National Register, and since several Federal agencies are involved in the project, a Section 106 Review must be undertaken. Section 106 review is a Federal review process called for in the National Historic Preservation Act of 1966; it is designed to ensure that historic properties are considered during Federal project planning and execution.

The first step of the review is the identification and evaluation of the historic and archaeological resources. The lead Federal agency--in this case the Environmental Protection Agency--and the Massachusetts Historical Commission together will apply National Register criteria to decide whether these resources are eligible for listing and thus subject to the Section 106 process. This step is in the process of being accomplished.

When the plan for the secondary treatment facilities has been finalized, the EPA must determine whether the project will affect the historic properties. The EPA, working with the MHC, will determine if there will be an effect on the properties, and if so, whether the effect is adverse.

If the effect is adverse, the EPA, MHC and other interested parties will enter into a consultative process to find acceptable ways to avoid or mitigate the adverse effect to the properties. When the consulting parties have agreed on steps to mitigate or reduce harm to historic properties, they will sign a Memorandum of Agreement (MOA). The MOA will be submitted to the Advisory Council on Historic Preservation for its review. If accepted by the Council, the EPA will then proceed with the treatment facilities project according to the terms of the MOA.

<u>Protection of Resources</u>

While early site preparation construction activities will not directly affect any of the historic or archaeologic resources on Deer Island, it is anticipated that various protective measures may be identified in an MOA which would ensure against potential indirect impacts associated with site development. These protective measures will be finalized upon completion of site planning activities, which will resolve, in conjunction with the 106 Review, the disposition of each of the historic and archaeologic resources. Protective measures may include the following:

- o Restriction of construction activities in proximity to historic and archaeologic resources;

- Provision for security fencing and/or other security measures, as appropriate;
- Prevention of further deterioration of structures;
- Provision for a monitoring system to ensure that protective measures are implemented and maintained.

Section 8.3 References

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8.4 MITIGATION MEASURES

A significant mitigation package was developed as an integral part of MWRA's decision to site the new secondary treatment facilities on Deer Island. Because MWRA is committed to alleviating the impacts associated with the construction and operation of the treatment facilities, the previous mitigation commitments are also an integral part of the facilities planning process.

The mitigation commitments address a broad range of environmental, technical, and insitutional issues for both construction and operation of the secondary treatment facilities. Summary descriptions of each of the mitigation commitments, and a statement of the applicability of each commitment for use as an evaluation criterion, were provided in the Technical Memorandum - Proposed Criteria For Detailed Evaluation of Alternatives, Secondary Treatment Facilities Plan, dated May 13, 1987. These commitments were reviewed to categorize all necessary mitigation commitments and associated environmental controls which support the early site preparation plans. A summary of the commitments and associated environmental controls specific to the recommended plan for early site preparation is provided below.

Air Emissions and Odor Control

- Excavation and disposal of the grit and screenings will be performed during the cooler months (November through April) to minimize odors.
- Fugitive dust from earthmoving activities will be controlled by the use of sprinkling trucks.

Noise Control

- A visual and noise barrier berm will be constructed at the northernmost portion of Deer Island to attenuate noise resulting from earthmoving and other construction activities.
- Specially quieted construction vehicles, construction methods, and other controls such as the use of a pile driving noise shroud, will be employed to minimize construction noise.
- A construction noise monitoring program will be developed and implemented.
- Construction activities which affect off-island noise, such as the construction of the noise berm and landforms at the northern end of Deer Island, will be limited to one shift, daytime operation.

Barging

- o To mitigate transportation impacts associated with the construction of the grit and screenings secure landfill. 17.000 yd^3 of sand used for installation of the leachate collection system will be transported to Deer Island by barge.

Relocation of Deer Island House of Correction

- o With respect to consideration of technical. environmental. institutional. and cost criteria. the recommended plan requires relocation of the House of Correction with access to the entire prison property by 1989.

Further Measures

Historical/archaeological resources will be protected during early site preparation by:

- o Restricting construction activities activities in proximity to historical/archaeological resources;

- o Providing security fencing and/or other measures as appropriate;

- o Preventing further deterioration of historic structures (i.e.. removal of encroaching vegetation. debris. etc.);

- o Providing temporary panels to seal doorways. windows. etc.. and ventilation as required;

- o Providing a monitoring system to ensure that protective measures are implemented and maintained.

The potential for erosion and sedimentation associated with earthmoving activities will be controlled by:

- o Diverting surface runoff away from areas under construction by the use of hay bales and/or diversion ditches;

- o Directing surface runoff from areas under construction to holding ponds. silt traps. etc.;

- o Providing temporary stabilization of graded areas by seeding. tacking. or mulching until permanent cover is established.

All mitigation commitments summarized above are based on the implementation of the recommended

plan for early site preparation. The determinative element for implementation of the recommended plan is the requirement for the relocation of the House of Correction by 1989. If relocation of the House of Correction is delayed, a phased implementation of the early site preparation activities will be required, as described in section 7.1. The phased implementation of early site preparation would result in the need for additional mitigation commitments, including the following:

- o The existing prison recreational area would be relocated to the southeast of Hill Prison.
- o Consideration has been given for the construction of a noise barrier wall which would attenuate earthmoving noise within the prison area. As described in section 8.3.5, it is impractical to control earth moving noise at all locations within the prison. However, it may be possible to consider provision of a noise barrier wall for a specific location(s) within the House of Correction, such as for the relocated prison recreational area.

8.5 INSTITUTIONAL CONSIDERATIONS

The purpose of this section is to evaluate the recommended early site preparation activities according to the institutional criteria agreed upon previously by the MWRA Board of Directors.

Timely Implementation

The schedule of early site preparation activities is shown on Figure 8.5-1. Permitting has already begun with the May 1987 submission of the Corps of Engineers permit to allow the construction of a temporary landing area for barges for the off-loading of the sand required to construct the leachate collection system at the secure landfull.

The subsequent 3 1/2 years are required to complete the early site preparation activities. Construction activities will be scheduled and implemented to assure that the site is available for the start of primary plant construction in late 1990.

The early identification of these required federal, state and local permits and approvals is necessary to assure that adequate time is available within the proposed implementation schedule for permitting early site preparation activities and to support, as appropriate, the later court mandated deadlines for construction. The major federal, state and local permits and approvals which will be required are identified in Table 8.5-1. Table 8.5-1 also indicates those early site preparation activities which may cause the action to be subject to the permit requirements.

As shown in Table 8.5-1, the U.S. Army Corps of Engineers (COE), under Section 10 of the Rivers and Harbors Act of 1899, is required to assess the impacts of activities in navigable waters.

Project approval at the State level is coordinated by the Executive Office of Environmental Affairs (EOEA) under the provisions of the Massachusetts Environmental Policy Act (MEPA). Within the EOEA, major permitting acitvities are conducted by the Department of Environmental Quality Engineering (DEQE). DEQE has primary responsibility for the permitting of activities involving air and water quality.

Other State responsibilities include Coastal Zone Management (CZM) consistency and Section 106 Historic Preservation review under the purview of EOEA-CZM Program and the Massachusetts Historical Commission (MHC).

The identification of local permits and approvals in this report is limited to the regulation of activities in or near designated wetlands. Separate Orders of Conditions may be required for early site preparation activities proposed within Boston and Winthrop.

The permits which require significant lead time for application and review include those issued by COE, EOEA, DEQE-Division of Water Pollution Control (DWPC), and the MHC. Given the very short schedule for Early Site Preparation implementation, the asociated permitting activities must begin during the summer of 1987.

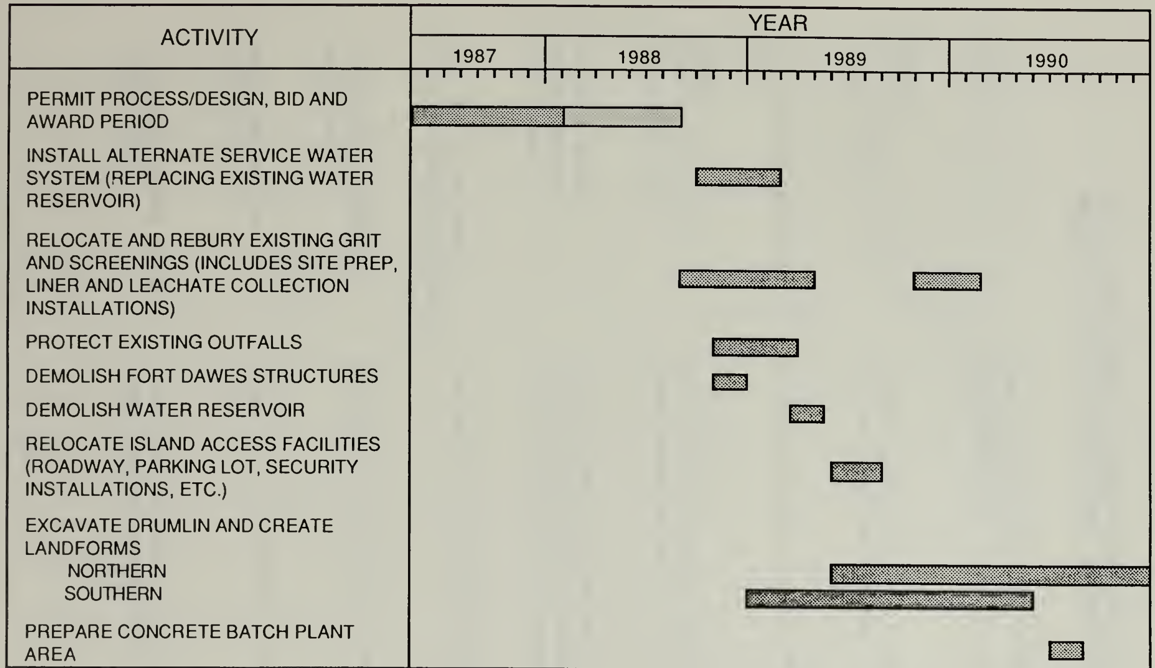
Permitting associated with early site preparation activities will require applications to the ACOE, DEQE, and the MHC in addition to the EIR/EID. Major permits will include appropriate ACOE Section; DEQE-DWPC residuals disposal and Water Quality Certification; CZM Consistency; MHC Section 106 Historic Preservation; and local Order of Conditions reviews and approvals. Since no material excavated during the early site preparation activity will be disposed of off-site, no major permitting obstacles are anticipated.

Coordination Requirements

The determinative external element for implementation of the recommended early site preparation activities is the requirement for relocation of the House of Correction by 1989. If relocation of the House of Correction is delayed, a phased implementation of early site preparation will be required which will entail increased costs associated with mitigative measures for the House of Correction.

Another external issue regarding the implementation of the early site preparation activities is the question of how the regulatory agencies will review the various permit applications. Given that this project has been designated a "major and complicated "project under the regulations of 301 CMR 10.10, it must be determined whether the appropriate permitting agencies will review each permit application with regard to specific project information, or as a whole. In addition, the MWRA will have to coordinate the early site preparation activities with the Town of Winthrop to mitigate related impacts.

An extensive degree of coordination will also be required internally within the Authority with respect to its other on-going and planned projects, including: daily operations; the



MASSACHUSETTS WATER RESOURCES AUTHORITY

FIGURE 8.5-1
SCHEDULE OF EARLY SITE PREPARATION ACTIVITIES

Table 8.5-1

MWRA DEER ISLAND SECONDARY TREATMENT FACILITIES
PROJECT EARLY SITE PREPARATION PERMITTING MATRIX

PERMIT/APPROVAL AGENCY	EARLY SITE PREPARATION ACTIVITY REQUIRING PERMIT/APPROVAL
FEDERAL	
ACTIVITIES IN NAVIGABLE WATERS* (COE)	Sediment dredging, construction of structures beyond the mean high water in navigable and territorial waters.
NOI-ASBESTOS REMOVAL (EPA)	Demolition if requiring removal of asbestos-covered material
STATE	
EOEA CERTIFICATION* (EOEA-MEPA UNIT)	State permitting, approval, or funding activities for projects meeting specified threshold criteria
WATER QUALITY CERTIFICATION* (DEQE/DWPC)	Federal or state permitting activities for actions involving discharges to water, such as the wastewater discharge, dredging, and construction of structures in navigable waters
CHAPTER 91 WATERWAYS LICENSE* (DEQE-WATERWAYS)	Construction of structures seaward of the high tide line
NOI-ASBESTOS REMOVAL (DEQE-DAQC)	Demolition if requiring removal of asbestos covered material
RESIDUALS DISPOSAL* (DEQE/DWPC)	Closure plans for existing Deer Island grit and screenings landfill
CZM CONSISTENCY REVIEW (MASS. CZM)	Federal funding/permitting action for activity located within or affecting the coastal zone of Massachusetts

Table 8.5-1
(cont.)
MWRA DEER ISLAND SECONDARY TREATMENT FACILITIES
PROJECT EARLY SITE PREPARATION PERMITTING MATRIX

PERMIT/APPROVAL AGENCY	EARLY SITE PREPARATION ACTIVITY REQUIRING PERMIT/APPROVAL
STATE	
SECTION 106 HISTORIC PRESERVATION REVIEW* (MHC)	Removal/modification of structures which are eligible for inclusion on the National Register of Historic Places
CHAPTER 21E REVIEW (DEQE)	Collection, storage, treatment, or disposal of hazardous waste if encountered during demolition activities
WETLANDS ORDER OF CONDITIONS* (BOSTON, WINTHROP CONSERV COMMS.)	Filling, dredging, removing or altering land in or near water bodies (within 100 ft of the 100-year flood plain).

NOTES:

*Permits requiring significant lead time
**To be addressed in combined EIS/FONSI

ABBREVIATIONS

COE	-	U.S. Army Corps of Engineers
CWA	-	Clean Water Act
CZM	-	Coastal Zone Management
DAQC	-	Division of Air Quality Control
DEQE	-	Department of Environmental Quality Engineering
DWPC	-	Division of Waste Pollution Control
EIR	-	Environmental Impact Report
EIS	-	Environmental Impact Statement
EOEA	-	Executive Office of Environmental Affairs
EPA	-	U.S. Environmental Protection Agency
FONSI	-	Finding of No Significant Impact
MEPA	-	Massachusetts Environmental Policy Act
MHC	-	Massachusets Historic Commission
NEPA	-	National Environmental Policy Act
NPDES	-	National Pollutant Discharge Elimination System

fast-track plant upgrading projects; the pilot program for composting; pier construction; interim sludge disposal; the alternative disinfection project; and others. The movement of material will be taking place in approximately the same area as these other projects.

8.6 PUBLIC PARTICIPATION SUMMARY

In facing the monumental tasks associated with the successful implementation of the Deer Island Secondary Treatment Facilities Plan, it was essential that the Authority institute a comprehensive public participation effort. The measures included in the workplan were designed to meet federal and state regulatory requirements associated with the project, to satisfy grant conditions, and to provide the most meaningful avenues of public input into the critical decisions to be made by the authority's facilities planners. Through this program, the MWRA Board of Directors will be assured that the Authority's dialogue with the public will be ongoing and that important policy decisions can be made in the context of maximum public knowledge and participation.

8.6.1 COORDINATION WITH OTHER HARBOR CLEAN-UP PROJECTS

Because the total Harbor clean-up program consists of many simultaneous efforts, the public participation activities associated with the Secondary Treatment Facilities Plan are being closely coordinated with public participation efforts being undertaken for other projects. Public participation coordination mirrors similar efforts on the technical side, particularly with regard to overlapping concerns. Coordination occurs on several levels:

- Engineering and Public Affairs project staff and technical and public participation consultants for both the Deer Island Secondary Treatment Facilities Plan and Residuals Management Facilities Plan meet on a bi-weekly basis (36 meetings) to discuss coordination efforts and review schedules and agendas for upcoming meetings.

- The public participation program is coordinated through the Authority's Public Participation Coordinator and augmented by other Public Affairs staff, including media, intergovernmental and community relations personnel, particularly when project components have a direct bearing on a particular community.

- The Citizen's Advisory Committee (CAC) serves to review work associated with both the Deer Island Facilities Plan and the Residuals Management Facilities Plan and is kept informed of developments on other projects such as water transportation, CSOs and setting of local limits for industrial discharges.

8.6.2 CITIZENS' ADVISORY COMMITTEE

In July, 1986 the Massachusetts Environmental Protection Act (MEPA) Unit of the Executive Office of Environmental Affairs (EOEA) served notice of the formation of a Citizens' Advisory for the Secondary Treatment Facilities Plan in the Environmental Monitor. In addition, notices were mailed to several hundred individuals and organizations and an announcement was placed in

On the Waterfront, the MWRA newsletter, which was mailed to over 1500 individuals, groups and agencies.

Pursuant to discussions among agencies, it was decided that this CAC would serve to review both the Secondary Treatment Facilities Plan and the Residuals Management Facilities Plan. Active members of the Authority's informal Citizens' Advisory Group (CAG) from Phase I of the Residuals Management Facilities Plan were solicited for nominations to the CAC.

On October 10, 1986, EOEA Secretary James S. Hoyte appointed the CAC, which consists of 28 representatives and 15 alternate members. The CAC consists of representatives of environmental, business, community, government and other interests. In addition, agency representatives serve in a non-voting capacity.

Technical support from Authority staff and consultants is provided to assist in interpreting data and reports for the CAC. Administrative support from Authority Public Affairs staff and public participation subconsultants includes preparation of agendas, minutes and CAC reports, and scheduling of meetings and workshops. In addition, funds have been allocated in the Authority's Capital Expenditure Budget to cover expenses the CAC may incur. A portion of the funds are earmarked for a staff person to serve the administrative needs of the CAC. The remainder of the funds are available to CAC members and alternates. Payments are coordinated through the CAC staff person and the MWRA Public Affairs Unit.

The CAC meet on a regular monthly basis and have chosen to form subcommittees to examine specific issues. These subcommittees meet on a monthly basis, as needed (total CAC meetings--38). When the Residuals Management Facilities Plan siting process has progressed to the "candidate options" phase, the Authority will encourage, in cooperation with the MEPA Unit, the formation of "satellite" CACs to address the concerns of potentially impacted communities. At that time, local officials, groups and activists will be solicited for representation on the local CACs in conjunction with the Authority's Community Relations Coordinators for those particular regions.

In addition, a minimum of three workshops is being scheduled during the facilities planning process. Those currently scheduled are on scoping, outfall siting and performance criteria; others will be determined by the CAC.

Materials are generally distributed to the CAC at the end of its meeting for discussion at the following month's meeting. At times it is necessary to distribute these materials through the mail, but sufficient time is allocated for the CAC members to review the information and prepare for the discussion. Agendas, minutes and certain other materials are also distributed prior to the CAC meetings.

In general, the CAC meets on the fourth Monday of each month from 4:30 to 6:30 p.m. at a location agreeable to the majority of participants. Sub-group meetings are scheduled for the early part of each month as needed.

8.6.3 TECHNICAL ADVISORY GROUP

As an adjunct to the public participation program. a Technical Advisory Group (TAG) has been formed to provide a mechanism for input from involved agencies and technical advice and support to the Citizens' Advisory Committee. Representatives of agencies involved in regulatory, permitting, funding or other capacities were solicited by the MEPA Unit of EOEA for membership on the TAG, as were former members of the Siting EIS TAG formed under EPA's auspices.

In order to benefit from the Authority's presentations to the CAC and to assist the citizen representatives in understanding technical issues. TAG representatives are invited to attend all CAC meetings and workshops. They are provided with documents in advance of the meetings and are asked to provide written review and comment. to be returned to the Authority in a

timely fashion.

By this arrangement, the Authority can benefit from the advice of the TAG without devoting large portions of the CAC's agenda to technical discussions which the citizen representatives may not understand. The TAG is also free to meet on its own or at the request of the agencies, such as the EPA.

8.6.4 PUBLIC MEETINGS

Public meetings fall into several categories:

A. Forums--In order to clarify the Authority's overall program for interested constituent groups and the public at-large, forums will be held three times over the course of the planning period. These forums will be co-sponsored by the Authority, its umbrella public advisory group "Waterfront," and a well-known institution such as the Chamber of Commerce, the Massachusetts Bay Marine Studies Consortium or the Museum of Science. Through this mechanism, the Authority will have an opportunity to present a total picture of the harbor clean-up and provide an opportunity for meaningful public interaction.

B. Public Information Meetings--Public information meetings will be held at project milestones, including: outfall screening and technology--March (two locations, Lynn and Quincy); site preparation, alternative site layouts and recommended inter-island alternatives--July and EIR recommendations--September (Boston).

C. Meeting with Impacted Communities--In addition to its attempts to educate the CAC and the public at-large, the Public Participation Program must address the concerns of communities to be impacted by the results of the decisions made during the study. The Authority's Community Relations liaison with the Town of Winthrop attends monthly meetings of the Town's Representative Citizens Committee to keep them abreast not only of ongoing operational and fast-track upgrade issues at the existing primary plant, but also of the progress of the Secondary Treatment Facilities Plan. The Authority will also hold regular public meetings with the Winthrop community at large to update them on the Secondary Treatment Facilities Plan and to hear public concerns regarding key decisions.

   Similarly, the Authority's Boston/Quincy Community Relations Coordinator attends monthly Nut Island CAC meetings and works with the STFP project team in scheduling meetings in Quincy and in the Boston neighborhoods of South Boston and Ward Street, where remote headworks facilities are located. The Community Relations Coordinator for the northern sector of the MWRA service area provides similar coordination efforts to inform the neighbors of the Chelsea Creek headworks and communities potentially affected by outfall siting decisions.

   Local elected and appointed officials are kept informed of all developments in the Facilities Plan relative to their concerns through the Public Participation and Community Relations Coordinators. There will be community meetings in Winthrop (6), Quincy (6),

(3) for a total of 21 community meetings. Meetings
, are presented in Table 8.6.1-1.

ıted for "special request" meetings with the MWRA
organizations. There will be three Public Hearings at
.tion background and inter-island conduit in July
utional considerations; and one on outfall.

: information meetings and public hearings will be
ıblic meeting.

'ITIES

)ject team is involved in development of
'S, public service announcements, press releases.
'eness summaries. and fact sheets for use at public
)n through mailing lists, repositories, schools.
ıters.

OMMENTS

'd plan for early site preparation. preliminary
es were provided to the CAC (July 23. 1987):
ıtives from Winthrop and Quincy (July 15. 1987); and
987). Comments received from these meetings have
ılternatives which would have entailed temporary
ıns which affect the Winthrop community.

:nt period. in accordance with procedures adapted for
ıtal Affairs. will commence with the submittal of

TABLE 8.6.1-1

Community Meetings
For
Early Site Preparation

Date	Subject
June 1, 1986	Mitigation commitments and planning. Conceptual site layouts (Harbor Perspective), flows and loads.
April 22, 1987	Site development and inter-island alternatives.
June 29, 1987	Historical and archaeological resources. Site preparation.
July 16, 1987	Mitigation, preliminary implementation schedule. Performance criteria.
July 23, 1987	Early Site Preparation

Appendix A

APPENDIX A

FEASIBILITY STUDY AND ENGINEERING EVALUATION OF GRIT AND SCREENINGS TREATMENT BY <u>CHEMFIX</u> PROCESS

FEASIBILITY STUDY AND ENGINEERING EVALUATION
OF GRIT AND SCREENINGS TREATMENT
BY CHEMFIX® PROCESS

prepared for

Camp, Dresser, and McKee, Inc.
One Center Plaza
Boston, Massachusetts 02108

and

Stone & Webster Engineering Corporation, Inc.
245 Summer St.
Boston, Massachusetts 02143

prepared by

Chemfix Technologies, Inc.
2424 Edenborn Avenue, Suite 620
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July 1, 1987

EXECUTIVE SUMMARY

Chemfix Technologies, Inc. (CTI) was contracted by Camp, Dresser, and McKee, Inc. and Stone and Webster, Engineering Corporation, Inc. to conduct field sampling and treatment study of Grit and Screenings disposed on Deer Island by applying patented CHEMFIX® process. Based on the findings of the study, an engineering evaluation for the actual treatment was formulated.

The following highlights were evidenced by these studies:

The grit and screenings must undergo pretreatment by either grinding or shredding to reduce particle sizes prior to CHEMFIX® process.

The CHEMFIX® process can treat the grit and screenings with 15% water addition, and produce a final product with physical, chemical and biological stability. The final product can then be safely disposed of or beneficially reused on Deer Island. The volume increase of the in-place grit and screenings after CHEMFIX® treatment is approximately 3 percent.

After CHEMFIX® treatment, the final products showed significant improvement in strength and permeability, compared with field values anticipated for untreated grit and screenings. CHEMFIX® treatment also was observed to provide significant inactivation of bacteria contained in the grit and screenings. CHEMFIX® treatment provided for acceptable metal concentrations in EP-leachate testing. Samples of grit and screenings were heterogeneous so metals concentration

before and after CHEMFIX® treatment could not be directly compared. However, based on the results of similar tests performed for municipal wastewater treatment sludges, improvement in metal leachability of CHEMFIX®-treated grit and screenings would be expected.

The projected actual field treatment will take approximately 10 - 15 months to complete based on a single processing unit. If two units are utilized, the treatment time will be approximately 6 to 8 months. Best efforts will be made to ensure continuity of treatment operations through winter months. The treatment cost was estimated to be between $37.50 - $47.00 per cubic yard.

The reagent truck traffic to Deer Island was estimated to be approximately 9 - 10 trucks per week to support the requirements of a single processing unit.

TABLE OF CONTENTS

I. INTRODUCTION

Grit and screenings material from the North System headwork has been disposed of on Deer Island since the mid-1960's. It was estimated that approximately 72,000 cubic yards of material were deposited in four (4) major areas on the island.[1] These areas will be closed during 1987 as part of the activities required for the secondary treatment facilities planning project.

Chemfix Technologies, Inc., (CTI) initiated a bench scale treatability study of grit and screenings, on samples collected from Winthrop headworks and landfill area in October, 1986. The results on grit and screenings treated by the patented CHEMFIX® process indicated that the final product after treatment exhibited greater than 4.5 tons per square foot strength by penetrometer reading with minimum volume increase. During this initial study it was found that to adequately mix in the CHEMFIX® reagents to the landfill grit, it was necessary to add water prior to the treatment. The scum material generated by the waste water treatment plant was also added to facilitate the CHEMFIX® reaction. In this study, no chemical or biological analysis was performed on the CHEMFIX® product.[2]

Following the initial study, CTI received a contract from Camp, Dresser, and McKee, Inc. (CDM) in conjunction with Stone and Webster Engineering Corporation, Inc. to perform an indepth study to determine the feasible treatment of all grit and screenings deposited on the island. The study objectives were to characterize the physical, chemical and biological nature of grit and screening materials as well as the final CHEMFIX® product after treatment. The particle size reduction experiment was conducted to ensure

that the feeding material could be processed by the CHEMFIX® process units. Finally, an engineering evaluation was provided to estimate the costs, scheduling, utility, and operating requirements for treatment of the entire volume of the grit and screenings and to establish the guidelines for the actual full-scale treatments.

FEASIBILITY STUDY AND ENGINEERING EVALUATION OF GRIT AND SCREENINGS TREATMENT BY CHEMFIX® PROCESS

prepared for

Camp, Dresser, and McKee, Inc.
One Center Plaza
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July 1, 1987

II. DESCRIPTION OF TECHNOLOGIES

The CHEMFIX® process is a proprietary process that stabilizes wastes by chemical reaction. The generic term is chemical fixation/stabilization.

Stabilization as a waste treatment process has several objectives. The first objective is to generate a solid product from a liquid or semi-solid waste. The structural stability of the product allows for both easier and safer transport and disposal. Secondly, stabilization technology is used to immobilize potential pollutants in the raw material by chemical and physical reaction. Lastly, it is the objective of stabilization to inactivate pathogenic microorganisms present in raw municipal waste through pH change and ammonia generation.

The CHEMFIX® process is based on the use of soluble silicates and silicate setting agents. The combination and proportions of reagents are optimized for each particular waste requiring treatment. The two (2) part, inorganic chemical system reacts with polyvalent metal ions, certain other waste components, and also with itself to produce a chemically and physically stable solid material. The cross-linked, three dimensional polymeric matrix displays properties of good stability, high melting point, and a rigid, friable texture similar to that of a clay soil.

Three (3) classes of interactions can be described. First are the rapid reactions between soluble silicates and the polyvalent metal ions, producing insoluble metal silicates. Second, are reactions between the soluble

silicates and the reactive components of the setting agent, producing a gel structure. Third, are hydrolysis, hydration, and neutralization reactions between the setting agent and the waste and/or water.

When first blended with a waste, the CHEMFIX® reagents are dispersed and become dissolved throughout the aqueous phase. Reactions occur utilizing the reagents, polyvalent cations in the waste, and some of the water. As a result of these reactions, inorganic polymer chains form throughout the aqueous phase and physically entrap the organic colloids within the micro-structure of the CHEMFIX® product matrix. The pore diameters of this matrix are too small to permit any significant migration of the organic colloids. Reactions involved in the CHEMFIX® process begin immediately with addition of reagent.

Within the CHEMFIX® process, the water soluble silicates are reacted with complex cations in the presence of a silicious setting agent. At least two (2) general types of reactions occur.

1. Amorphous, colloidal silicates will form. These silicates are extremely complex and the chemical formulae will vary depending upon. (a) pH, (b) availability and concentrations of cations, and (c) temperature. These properties vary as the reactions proceed, thus, various silicates are formed.

   Silicate anions are in the form of double trigonal and tetragonal rings of the $(Si_6O_{15})^{-6}$, $(Si_8O_{20})^{-8}$, and $(Si_8O_{18}(OH)_2)^{-6}$ compositions.

2. SiO_2 acts as a precipitating agent. The metallic precipitates generally are developed within the physical structure formed during the precipitation of amorphous colloids. This seals the faces of those particles, which making them impermeable to water.

Most of the heavy metals contained in the waste become part of the complex silicates with some of the heavy metals precipitating within the structure of the complex molecules. However, a very small percentage (estimated to be less than one percent) of the heavy metals precipitate between the complex silicates and are not chemically immobilized.

Some organics may be larger particles than the colloids. During the CHEMFIX® process treatment, all of the waste is pumped through processing equipment which creates sufficient shear to emulsify such organic constituents. Emulsified organics then are immobilized as described above.

This mixture is discharged to a prepared solidification area in which the gel continues to set. Cementitious reactions create a solid which, though friable, encases within its macrostructure organic substances which may have escaped emulsification. Such substances are immobilized by the impermeability of the macrostructure. Theoretically, migration could occur, but the rate would be extremely slow.

Portions of water contained in wastes which are treated by the CHEMFIX® process are involved in three of reactions.

- 1. Hydration similar to that of cement reactions.
- 2. Hydrolysis reactions.
- 3. Equilibration with the environment through evaporation.

There are no side streams or discharges resulting from the CHEMFIX® process. During processing, all the waste is pumped into the reaction vessel wherein the reagents immediately react to form a gel. This gel is then discharged to the receiving area. Even at this early stage, the water in the CHEMFIX® product does not form a separate phase. Some of the water becomes part of the solids, but most is physically bound in the hydrophilic CHEMFIX® product. Although it can evaporate, it is not free water.

Pathogens, which include many forms of bacteria, viruses, and parasite eggs, exist in all untreated municipal sludges. The CHEMFIX® process is effective for the inactivation of selected indicator organisms tested in municipal sludge. The CHEMFIX® process has resulted in reductions ranging from 2 to 12 logs of bacterial indicators in previous studies[5]. Disinfection of bacteria, and viruses is related to pH. The CHEMFIX® reagents, Portland cement and silicate, are both basic and Portland cement is highly alkaline. The final CHEMFIX® product typically reaches a pH of 11.5 to 12 S.U. In this high pH environment, bacteria and viruses are inactivated and ammonia is released. At concentrations of greater than 1 percent ammonia, the parasite eggs are inactivated.

III. OBJECTIVES OF THE STUDY

- To demonstrate the feasibility of CHEMFIX® treatment of grit and screenings contained in the disposal areas on Deer Island.

- To analyze the physical, chemical and biological characteristics of raw and CHEMFIX® processed grit and screening material for evaluating its environmental and structural suitability for final disposal on Deer Island.

- To investigate the grinding or shredding operation as pretreatment of grit and screenings before the CHEMFIX® process.

- To provide actual CHEMFIX® process data including costs, scheduling, utility and operating requirement for treatment of the total volume of grit and screenings at the landfill site.

IV. FEASIBILITY STUDY OF GRIT AND SCREENINGS TREATMENT BY CHEMFIX® PROCESS

A. SAMPLE COLLECTION

Sample collection was performed on April 21, 1987. CTI personnel, Dr. C. Paul Lo, Mr. Bruce A. DuFresne, and Mr. Don J. Guillory arrived at Deer Island to collect grit and screening samples. Mr. Andrew J. Mills, representing Stone and Webster Engineering Corporation, Inc. accompanied the sampling crew. Mr. Mills located each sampling point which was preselected and staked out, at four (4) different landfill areas (Area 1, 3, 6, and 7) as shown on Figure 1.

Areas 1, 3, 6, and 7 shown in Figure 5-1 of the Plan of Study (Appendix A), were sampled. No changes were made to the sampling plan for Areas 6 and 7. For Area 1, the largest of the four disposal areas, it was not possible to sample from locations 1, 2, and 9 since recent filling operations created hilly topography which prevented access by the backhoe. Sampling locations for these three were moved as shown on Figure 1. For Area 3, the original sampling plan provided for taking three samples; the plan was based on a presumed extent of the limits for this disposal area which extended about 25 ft. up from the southern base of the drumlin. According to the backhoe operator (who was the individual responsible for filling this area about 10-15 years ago), grit and screenings were disposed in two, 10 ft. deep trenches, each parallel to, and located at the base of the drumlin, and <u>not</u> extending upslope. This recollection appears to be substantiated by the fact that the slope of the drumlin in this disposal area is stable, supports grass, and in

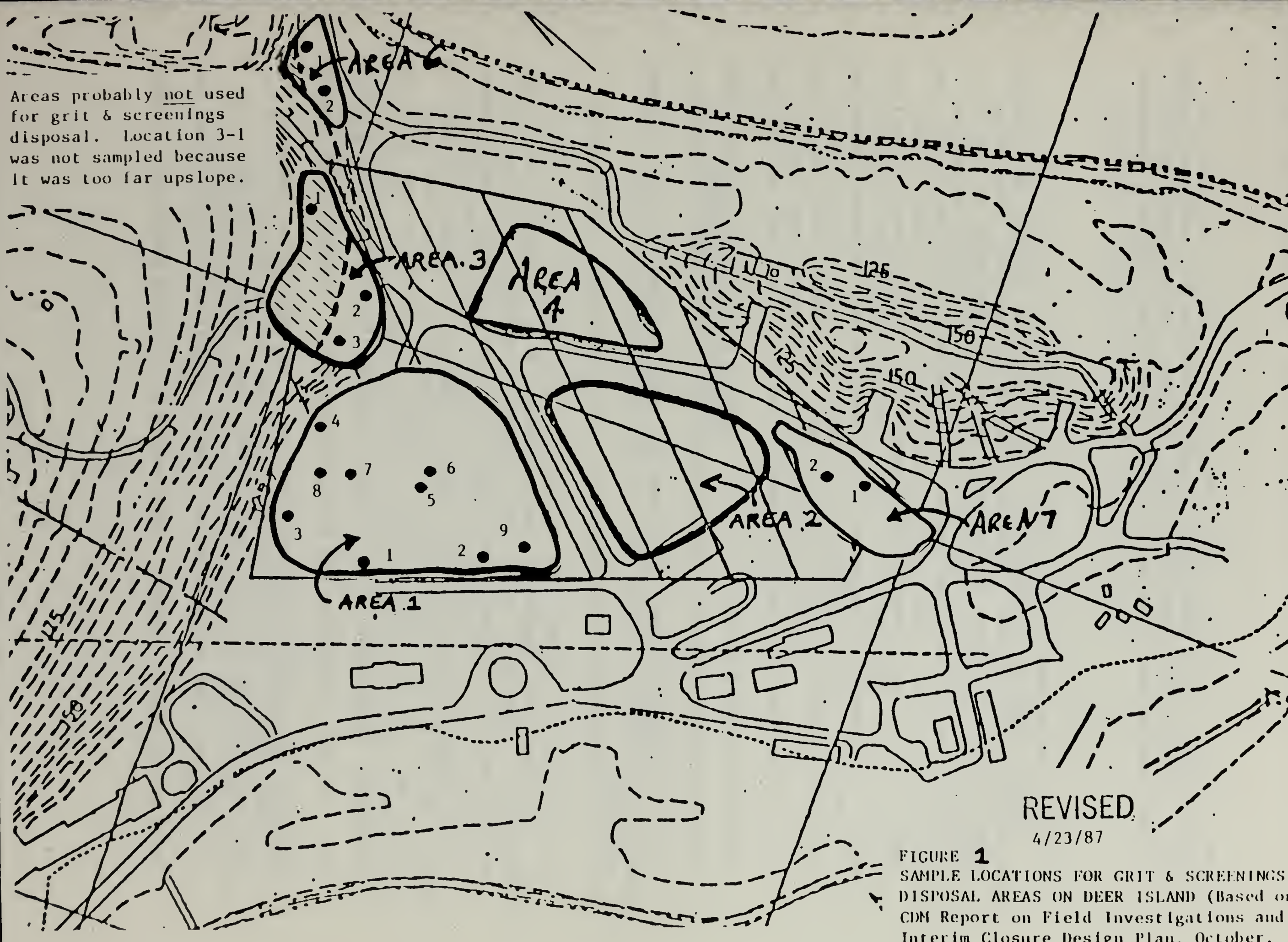

FIGURE **1**
SAMPLE LOCATIONS FOR GRIT & SCREENINGS DISPOSAL AREAS ON DEER ISLAND (Based on CDM Report on Field Investigations and Interim Closure Design Plan, October, 1986).

Scale : 1" = 200'

general appears to be undisturbed. Sampling location 3-1, which was located upslope from the known grit and screenings deposits, was therefore eliminated.

During sampling, a backhoe was used to dig out trenches approximately eight (8) feet by three (3) feet wide by six (6) feet deep at each point. Personnel from CTI collected samples from each wall inside the trench. The samples of grit and screenings were taken with a shovel across the vertical wall of each trench. It appeared that the depth of each excavated trench was sufficient to obtain a representative sample. At sampling locations 1-1 and 6-1, the vertical cut contained sample from the total depth of grit and screenings disposed at that site. The disposed grit and screenings at those locations were observed in an identifiable layer, and continued excavation up to 2-3 ft. beneath the grit and screenings layer revealed no further disposed materials.

The first area sampled was the southernmost Area 7. Whether because this area may be older than the other disposal areas, or as is more likely, because it was sampled during the coldest time of the day, it appeared to have the least odor of all areas sampled. During the course of the day, air temperature warmed about 20 C; all areas sampled after 10:00 AM had a strong odor. The odor represented the typical sewage smell. At none of the sampling locations were petroleum wastes either seen or smelled. It was observed that large objects such as tires, waste lumber scrap, rocks and boulders up to 2 ft. diameter, steel reinforcing rods, cable, asphalt and concrete slabs were found in the sample trenches. Prescreening of grit and screenings is needed

during actual treatment. Chlorinated primary effluent was collected from the pumping house to be used for CHEMFIX® process optimization. Table 1 summarizes the sampling condition at each point.

At least 10 - 15 gallons of grit and screenings samples were collected at each point. Samples were placed in three (3) five (5) gallon plastic pails, sealed and labelled. Two thirds of each sample collected was shipped to St. Louis, Missouri, for grinding/shredding experiment. The rest of the grit and screenings and primary effluent samples were shipped back to CTI's laboratory, located at St. Rose, Louisiana. All sample shipments were made through Federal Express overnight service to each location.

B. GRINDING/SHREDDING EXPERIMENT

In this study an effort was put into gaining information or equipment available for shredding grit and screenings prior to CHEMFIX® process. Cost and availability on equipment ranging from tree shredders to shredders used at the municipal wastewater treatment plants were investigated. The Ripshear® shredder manufactured by the Williams Patent Crusher and Pulverizer Co, St. Louis, Missouri, was selected for this study both because of its favorable reputation and the availability of a pilot scale model for use during this project.

Grit and screenings samples were delivered to the Williams Patent Crusher & Pulverizer Co.,(Williams), St. Louis, Missouri, for grinding and shredding

TABLE 1
SAMPLING LOG OF GRIT AND SCREENINGS
AT DEER ISLAND (4/21/87)

SAMPLING LOCATION	TIME	DESCRIPTION
7-1	8:35 AM	Area overgrown by 5 ft. tall grasses; 2.5 ft. cover, contains some asphalt chunks; sampled down to 4.5 ft. depth, mixed grit and screenings (g&s) contains some scrap lumber; saturated zone at 3.5 ft. depth; v. slight odor.
7-2	9:00 AM	Same vegetation as 7-1; 3.0 ft. cover; mixed g&s sampled down to 6.0 ft., also contains scrap lumber and rocks; drier than 7-1, no saturated zone observed; little to no odor.
1-5	9:45 AM	Standing water in sampling area drained into sampling trench; 1-1.5 ft. cover; mixed g&s sampled down to 4.5 ft. includes tire; fresh, strong g&s odor.
1-6	10:00 AM	Much standing water in sampling area, which drained into sampling trench; 1.5 ft. cover; trench excavated to 3.5 ft.; g&s sampled from excavate because trench filled with surface drainage; odor not as strong as at 1-5.
1-8	10:15 AM	3.0 ft. cover; mixed g&s sampled down to 4.5 ft.; strong g&s odor.
1-3	10:30 AM	Cover approximately 4.0 ft. deep; excavated down to 6.5 ft. g&s sampled from excavate because of the depth of the trench; strong g&s odor; saturated zone at about 6.0 ft. depth.
1-4	10:45 AM	2.5 ft. cover; saturated zone at about 4.5 ft; g&s sampled down to about 5.05 ft.; strong g&s odor.
1-7	12.15 PM	Cover material 2.0 ft.; g&s sampled down to 5.0 ft.; strong g&s odor.
1-1	12:25 PM	Original 1-1 could not be sampled, since ungraded fill dumping piles prevented access for backhoe. Sample trench was moved approximately 30 ft. N of original 1-1, which was accessible. Excavated down to 7.0 ft. - no g&s were observed. Sampling trench was moved again, to about 3 ft. E of the concrete wall. Cover depth varies in this area due to fill dumping; at sample trench, cover depth was 1-3.0 ft. deep; a 6 in. to 1.5 ft. grit layer was observed over clean soil; sample was taken from the grit lense.
3-2	12:50 PM	Trench was excavated at the base of the drumlin; 3.0 ft cover; g&s sampled down to 6.0 ft.; strong g&s odor.

3-3	1:00 PM	Trench was excavated about 10 ft. from a chain fence, and 20 ft. from a hydrant. Backhoe operator indicated that for area 3, 2 trenches were dug and filled about 10 to 15 years ago; sample locations 3-2 and 3-3 were in these trenches; sample location 3-1 was outside of the actual disposal area, according to the operator, who advised that g&s in this area and for area 6, were only disposed in parallel trenches at the base on the drumlin and on level ground. Because of this information, location 3-1 was not sampled. Cover for location 3-3 was about 1.0 ft. deep; sample of g&s taken down to 4.5 ft.; no saturated zone observed; strong g&s odor.
6-2	1:15 PM	Cover in this location varied from 1.0 to 2.5 ft. deep; g&s sampled down to 4.5 ft.; no saturated zone observed; strong g&s odor.
6-1	1:25 PM	1.5 ft. cover; trench excavated to about 4.5 ft. depth, screenings observed in a 1.0 ft. layer.
1-2	1:45 PM	Original sample 1-2 was located in an area inaccessible by the backhoe because of fill dumping. The sample location was moved about 250 ft. S of the original location, to a fill plateau area. According to the operator, g&s in this area were placed in about 6 in. lifts, and then covered with fill. Cover about 1.0 ft. deep, but g&s were mixed in with the cover at this sampling location; at least four g&s layers were observed, each about 6 in. to 10 in. thick; trench was excavated down to 6.0 ft.; strong g&s odor.
1-9	1:55 PM	Sampling location was moved as shown on the attached, revised Figure 5-1, and was located on top of the same fill plateau as location 1-2. Sampling conditions at 1-9 were the same as for 1-2; g&s were sampled down to 6.0 ft.; strong g&s odor.
	2:15 PM	The original 1-9 location was hand-excavated down to 25 in. Cover material was 22 in. thick, which overlay a 1 in. thick layer of black, organic material (different in appearence from either grit or screenings, and not having any recognizable odor). Under the black layer was grey, silty-clay soil containing gravel and rock. No g&s were observed down to 25 in. depth; the bottom soils at this depth were too hard to dig further.
	3:00 PM	Picked up samples of chlorinated primary effluent for use by CTI in the CHEMFIX evaluation. All samples were transported off-island and air-freighted to a grinder-shredder manufacturer and to CTI's Louisiana facilities for testing.

on April 24, 1987. Dr. C. Paul Lo and Mr. Bruce A. duFresne were present during the experiment.

A 150 HP Ripshear® shredder was utilized at the Williams testing laboratory. This shredder was a hydraulically powered machine with 4140 flame hardened cutters.

During testing, individual samples from each container were processed separately, and returned to their sample containers. Initially, an attempt was made to simulate a continuous conveyor feed; the shredder was started and the samples were emptied into the machine. Four trials were run using this procedure. The time required for processing was dependent upon the ease with which the material could be emptied from the buckets. It was decided that this was not a good procedure. All remaining trials were slug fed, that is, the buckets were emptied into the machine while it was stationary. The machine was then started and the time required to process all of the material was recorded.

It took approximately 3 to 5 seconds to process material varied from 47 lbs. to 93 lbs. by weight. The resulting processing rates were calculated to be between 16.9 and 55.8 ton per hour with an average of 36.2 ton per hour. On the trial for sample 1-5, a large rock measured by 6″x6″x3″ was encountered. This piece of rock was ground up in 60 seconds after spending most of the time rolling around until it could be captured against an end bulkhead and grabbed by the cutter teeth. It became apparent that with more

material in the hopper holding the rock in close contact with the cutters, it would have passed much more quickly.

Following processing, the typical particle size was approximately 1″ x 1″, while the length was somewhat variable. Thin plastic would get cut into strips up to 12″ long and it was possible for small sticks to drop through virtually untouched. This was due to cutter geometry and clearance between cutter tip and adjacent shaft. With proper adjustment of cutter, the particle sizes could be further reduced. In any case, these particles present no problem to CTI's pugmill or other equipment.

At the end of the experiment, Williams personnel demonstrated the capability of this shredder to handle materials might be encountered in the disposal area on Deer Island. Tires, electric conduits, lumber, rocks and steel bolts were placed in the shredder. The shredder handled these materials very easily without jamming.

After shredding, the materials were placed back in their original containers, sealed, and shipped back to CTI's laboratory located at St. Rose, Louisiana through Federal Express shipment.

C. CHEMFIX PROCESS REAGENT OPTIMIZATION

1. Sample Preparation

Both ground and unground material were received at CTI's laboratory. The unground samples were achieved for future reference. Only ground samples were used in the testing. Ten (10) gallons of refrigerated primary effluent were also received. The grit and screenings in each container was very much the same in each location and at each site within the location except location 7-1. The typical sample was dry, with large pieces of plastic, tin cans, rock, paper, glass, twigs, hair, and rubber. The samples had a sewage odor and no free liquid. The sample collected at 7-1 contained small particles, was black in color and has a fairly large volume of free water.

The samples were well mixed with an electric mixer before a compositing. The area composite was made with equal weight of samples from each sampling point in each area. A total composite including every sample point was also made by equal weight basis.

2. Sample Dilution

The total composite sample of raw material was diluted with primary effluent collected to Deer Island to determine the optimum solids content that would facilitate reagent mixing and produce the best product.

Effluent was added in the following amounts and well mixed:

Raw Material (gm)	H_2O (gm)	Dilution (%)	Approximate Final Solids (%)
5,000	2,500	33%	48%
5,000	1,500	23%	52%
5,000	500	9%	59%

3. Reagent Addition

The optimum reagent ratio was determined by varying the amount of CHEMFIX® reagents added to each 500 gram portion of each diluted area composite and total composite samples. To each sample, a specific amount of dry reagent was added and mixed in with a high speed mixer. The silicate was then added, and mixed in. The Portland cement and silicate solution were added in amounts from B(I) to G(IV); these are proprietary designations referring to reagent ratios. After mixing, the sample was gently pressed down so that it would form a single mass. This procedure represented field conditions where the weight from the most recent product will compact the product below.

Pocket penetrometer readings on the CHEMFIX® product were taken after 24, 48 and 72 hours of curing at room temperature to determine the hardness of each solidified sample.

4. Final CHEMFIX® Product Preparation

Solidified samples with varying amounts of water were checked by the engineers of CTI's Operation Department. Both the CHEMFIX® reagent ratio and water dilution was selected based on the physical appearance of solidified material and cost for processing. A large batch of each area composite and total composite was then prepared with a 15% dilution at the f(II) ratio. For unconfined compressive strength and permeability, product was packed into the appropriate tube before curing at room temperature. After curing, these samples were divided up for analysis.

D. <u>ANALYSES</u>

1. Raw Grit and Screening Material

On each of the 15 individual samples, and the total composite, pH, density, total and volatile solids were measured. The total composite was further tested for volatile organic compounds, total metal and leachable metals (As, Ba, Cd, Cr, Pb, Hg, Se, Ag), total and fecal coliform bacteria, unconfined compressive strength (UCS), permeability, and oil and grease contents.

2. CHEMFIX® Product

On each of the four (4) area and total composite samples, unconfined compressive strength (UCS) permeability and bulk density were analyzed. The total composite was further tested for total

Kjeldahl nitrogen (TKN), total metal and leachable metals (As, Ba, Cd, Cr, Pb, Hg, Se, Ag), total and fecal coliform.

The analysis of metals, volatile organics, oil and grease, and TKN were performed by Environmental Industrial Research Associates, Inc. (EIRA), St. Rose, Louisiana. The UCS and permeability were analyzed by the Eustis Engineering, Inc., Metairie, Louisiana. The total and fecal coliform were analyzed by the Central Analytical Laboratory, Kenner, Louisiana.

Tables 2 and 3 outline the testing performed and the appropriate methodology.

E. RESULTS AND DISCUSSION

1. Physical Characteristics of Grit and Screenings

Each individual sample was analyzed for pH, total solids, volatile solids and density. Table 4 summarizes the results. In general, the pH ranged from 5.2 - 7.2 S.U. The total solids were determined to range from 34.5 to 81.4 percent. To the total solids, there were 32.7 to 91.6% of volatile solids. This was due to higher contents of plastics, papers, cloth, and other organic materials.

The total composite sample was analyzed for oil and grease, unconfined compressive strength (UCS), and permeability. Table 5

TABLE 2.

ANALYTICAL METHODOLOGY FOR RAW GRIT AND SCREENINGS

PARAMETERS	SAMPLES	METHODOLOGY
pH	1. Individual 2. Composite	9045 (1)
Density	1. Individual 2. Composite	D4292 (2)
Total Solids	1. Individual 2. Composite	209A (3)
Volatile Solids	1. Individual 2. Composite	209D(3)
Volatile Org.	1. Composite	2230, 8240 (1)
Total Coliform	1. Composite*	908A (3)
Fecal Coliform	1. Composite*	908C (3)
Oil and Grease	1. Composite*	503A (3)
UCS	1. Composite*	D2820 (2)
Permeability	1. Composite*	D698 (2)
Total Metals: Arsenic Barium Cadmium Chromium Lead Mercury Selenium Silver	1. Composite*	As : 3050, 7060 (1) Ba : 3050, 7080 (1) Cd : 3050, 7130 (1) Cr : 3050, 7190 (1) Pb : 3050, 7420 (1) Hg : 7471 (1) Se : 3050, 7740 (1) Ag : 3050, 7750 (1)
EP Metals: Arsenic Barium Cadmium Chromium Lead Mercury Selenium Silver	1. Composite*	EP Extraction: 1310 (1) As : 7060 (1) Ba : 7080 (1) Cd : 7130 (1) Cr : 7190 (1) Pb : 7420 (1) Hg : 7470 (1) Se : 7740 (1) Ag : 7750 (1)

* : Duplicate Analyses.
(1) : Test Methods for Evaluating Solid Wastes, EPA, SW-846, 1982.
(2) : Annual Book of ASTM Methods, 1984.
(3) : Standard Methods for the Examination of Water and Wastewater, 16th Edition, 1985.

TABLE 3.

ANALYTICAL METHODOLOGY FOR CHEMFIX PRODUCTS

PARAMETERS	SAMPLES	METHODOLOGY
Density	1. Area Comp. 2. Total Comp.	D4292 (2)
TKN	1. Total Comp*	420A (3)
Total Coliform	1. Total Comp*	908A (3)
Fecal Coliform	1. Total Comp*	908C (3)
UCS	1. Area Comp. 2. Total Comp.	D1633 (2)
Permeability	1. Area Comp. 2. Total Comp.	Flexable Wall Methods, Geotechnical Testing Journal, Sep. 1986.
Total Metals: Arsenic Barium Cadmium Chromium Lead Mercury Selenium Silver	1. Total Comp*	 As : 3050, 7060 (1) Ba : 3050, 7080 (1) Cd : 3050, 7130 (1) Cr : 3050, 7190 (1) Pb : 3050, 7420 (1) Hg : 7471 (1) Se : 3050, 7740 (1) Ag : 3050, 7750 (1)
EP Metals: Arsenic Barium Cadmium Chromium Lead Mercury Selenium Silver	1. Total Comp*	EP Extraction: 1310 (1) As : 7060 (1) Ba : 7080 (1) Cd : 7130 (1) Cr : 7190 (1) Pb : 7420 (1) Hg : 7470 (1) Se : 7740 (1) Ag : 7750 (1)

* : Duplicate Analyses.
(1) : Test Methods for Evaluating Solid Wastes, EPA, SW-846, 1982.
(2) : Annual Book of ASTM Methods, 1984.
(3) : Standard Methods for the Examination of Water and Wastewater, 16th Edition, 1985.

TABLE 4.

PHYSICAL CHARACTERISTICS OF GRIT AND SCREENINGS

SAMPLE NUMBER	pH (S.U.)	DENSITY (gm/ml)	TOTAL SOLID(%)	VOLATILE * SOLID(%)
1-1	6.4	1.91	81.4	91.6
1-2	7.2	1.59	72.0	90.5
1-3	6.7	1.49	68.8	83.9
1-4	5.2	1.11	34.5	32.7
1-5	5.6	1.38	73.2	51.2
1-6	6.4	1.47	56.3	76.3
1-7	5.8	1.31	56.9	63.6
1-8	5.7	1.34	55.6	65.6
1-9	6.7	1.64	69.2	87.5
3-2	5.6	1.26	44.8	54.1
3-3	6.3	1.45	50.7	67.9
6-1	5.5	1.13	54.4	65.5
6-2	6.4	1.41	58.7	74.5
7-1	6.4	1.61	52.8	90.5
7-2	6.6	1.59	67.2	74.3
Composited	6.0	1.40	63.8	79.1

* : Volatile solids were measured as percent of total solids.

TABLE 5.

UNCONFINED COMPRESSIVE STRENGTH (UCS), PERMEABILITY, OIL AND GREASE OF COMPOSITED GRIT AND SCREENINGS

PARAMETERS	COMPOSITED SAMPLE	
	RUN 1	RUN 2
UCS (lb/sq.ft.)	3435	2335
Permeability (cm/sec)	1.4×10^{-7}	2.1×10^{-7}
Oil and Grease (mg/kg)	134000	107000

outlines the results. The composite sample had oil and grease contents between 107,000 to 134,000 mg/kg or 10.7 - 13.4%. At these levels of oil and grease, it would have no effect on the CHEMFIX® process.

The UCS ranged from 2335 to 3435 lb/ft.^{2}, and permeability ranged from 1.4 x 10^{-7} to 2.1 x 10^{-7} cm/sec. These values are likely to the artifact of compaction prior to analyses as required by the testing methodology and are not likely to represent the actual condition in the field. The ground up grit and screenings were very fluffy and exhibited no strength when received. It was estimated that the permeability of unground grit and screenings, as received, would be in the range of 10^{-2} and 10^{-4} cm/sec. based on its particle sizes and characteristics. The material must be hydrated first then casted in containers. Compaction was applied in order to hold up the shape for laboratory testing. The original shredded material exhibited no cohesive characteristics without compaction, the permeability was impossible to measure. The compaction would definitely reduce the permeability during testing.

2. Volatile Organic Analysis

The volatile organic analysis (VOA) was performed on the total composited grit and screening only. Table 6 lists the results. In general, very low concentrations of volatile organic compound were detected.

TABLE 6.

VOLATILE ORGANIC ANALYSES OF COMPOSITED GRIT AND SCREENINGS

VOLATILE ORGANIC COMPOUNDS	CONC. (mg/kg)	VOLATILE ORGANIC COMPOUNDS	CONC. (mg/kg)
Benzene	0.006	Ethyl benzene	0.078
Bromodichloromethane	<0.005	Methylene chloride	0.010
Bromoform	<0.005	1,1,2,2-tetrachloroethane	<0.005
Bromomethane	<0.005	Tetrachloroethylene	0.037
Carbon tetrachloride	<0.005	Toluene	1.400
Chlorobenzene	0.019	1,1,1-trichloroethane	<0.005
Chloroethane	<0.005	1,1,2-trichloroethane	<0.005
Chlorodibromomethane	<0.005	Trichloroethylene	0.005
2-Chloroethyl vinyl ether	<0.005	Trichlorofluoromethane	<0.005
Chloroform	<0.005	Vinyl chloride	<0.005
Chloromethane	<0.005	Acetone	0.400
1,1-dichloroethane	<0.005	Carbon disulfide	0.017
1,2-dichloroethane	<0.005	2-Butanone	0.200
1,1-dichloroethylene	<0.005	Vinyl acetate	<0.005
1,2-trans-dichloroethylene	<0.005	2-Hexanone	<0.005
1,2-dichloropropane	<0.005	4-Methyl-2-pentanone	<0.005
1,3-cis-dichloropropylene	<0.005	Styrene	<0.005
1,3-trans-dichloropropylene	<0.005	Xylenes (total)	0.380

Table 7 summarizes the volatile organics detected with their respected worst potential leachable concentration under Toxic Characteristics Leaching Procedure (TCLP). Assuming 100% of volatile organics were leaching out, the results showed that under this worst condition, the potential leachable volatile organics were all well below the regulatory levels under the revised RCRA toxicity test or TCLP test, proposed by the USEPA[4], and should not be considered hazardous.

3. CHEMFIX® Reagent Optimization

The shredded grit and screenings were diluted with preselected additions of 0, 9, 23, and 33 percent water. Identical reagent dosages were added to these samples. The objective was to achieve a wet sample which would facilitate adequate mixing and moisture for chemical reactions to occur, but to avoid free water.

The CHEMFIX® reagent addition, referred to by CTI designated code F(II), was selected as optimum. At 9% dilution or total solids of 59% a pocket penetrometer reading of greater than 4.5 ton/ft.^{2} was achieved at 48 hours after curing. At 23% dilution or 52% solids the pocket penetrometer read 4.5 ton/ft.^{2} at 48 hours after curing. This is the maximum reading on a pocket penetrometer. These values indicate a sufficiently hard product for final disposal or reuse. Even at 24 hours the product has already passed required strength limits, (2.5 ton/ft.^{2}) designated by Chemfix Technologies,

TABLE 7.

POTENTIAL LEACHABLE VOLATILE ORGANICS FROM COMPOSITED GRIT AND SCREENINGS

VOLATILE ORGANIC COMPOUNDS	TOTAL CONCENTRATION (mg/kg)	LEACHABLE CONCENTRATION (mg/l) *	PROPOSED ** TCLP LEVELS (mg/l)
Benzene	0.006	0.0003	0.07
Chlorobenzene	0.019	0.001	1.40
Ethylbenzene	0.078	0.0039	N.S.
Methylene chloride	0.010	0.0005	8.60
Tetrachloroethylene	0.037	0.0019	0.10
Toluene	1.400	0.070	14.40
Trichloroethylene	0.005	0.0003	0.07
Acetone	0.400	0.020	N.S.
Carbon disulfide	0.017	0.0009	14.40
2-Butanone (MEK)	0.200	0.010	7.20
Xylenes	0.380	0.019	N.S.

* : Based on 100 gm of sample leaching in 2 liter solution with 100 % leachability.

**: Federal Register Vol. 51, No. 9, Jan. 14, 1986.

N.S. : No Standard.

Inc. as shown in Table 8. This limit, 2.5 tons/ft^2, has been selected as the strength at which a claylike substance which is easily transported and spread at a landfill is produced. Past experience at treating diverse municipal and industrial waste is the basis for the selection of this strength limit.

Although the low water addition (9%) made a very hard product, this could possibly only be achieved by batch processing under laboratory conditions. It may not be applicable in the actual field process with a flow through system. At high water addition (33%), the final product was soft and a much longer curing time was required. In addition, more reagents were needed to compensate for additional water. This is not cost effective.

A dilution of 15% or approximately 55% of total solids was found to be the most economical and compatible to CHEMFIX® process based on the observation by CTI's experienced engineers. The 15% dilution material was treated at F(II) ratio and the penetrometer reading was confirmed at 4.5 tons/ft.^{2}. In the field, this water addition will have to be adjusted daily to compensate for heavy rains, snow melt or material itself.

Samples were cured in the laboratory at room temperature. Previous work at municipal sites in Massachusetts and New Jersey has shown that the curing time of CHEMFIX® material is slowed down during winter. Under winter conditions, the ability of CHEMFIX®

TABLE 8.

PENETROMETER READINGS (TON/SQ.FT.) ON GRIT AND SCREENINGS TREATED WITH CHEMFIX PROCESS AT VARIOUS WATER ADDITION

% DILUTION	RATIO	24 HOURS	48 HOURS	72 HOURS
0 %	B(I)	2.50	4.00	4.50
	C(I) *	4.50	4.50	4.50
	D(I)	4.50	4.50	4.50
	E(I)	4.50	4.50	4.50
	E(II)	3.75	4.50	4.50
	F(II)	4.75	4.50	4.50
	G(II)	4.25	4.50	4.50
	G(III)	4.50	4.50	4.50
	G(IV)	4.50	4.50	4.50
9 %	B(I)	1.30	3.00	4.50
	C(I)	1.10	1.50	4.50
	D(I)	1.50	2.00	4.50
	E(I)	1.80	2.00	4.50
	E(II) *	3.50	4.00	4.50
	F(II)	4.50	4.50	4.50
	G(II)	4.50	4.50	4.50
	G(III)	4.50	4.50	4.50
	G(IV)	4.50	4.50	4.50
23 %	B(I)	<0.10	0.50	2.75
	C(I)	0.25	0.75	1.50
	D(I)	0.30	1.25	2.75
	E(I)	1.80	2.75	4.50
	E(II)	3.00	4.25	4.50
	F(II) *	3.80	4.50	4.50
	G(II)	3.75	4.50	4.50
	G(III)	4.20	4.50	4.50
	G(IV)	4.10	4.50	4.50
33 %	B(I)	<0.10	0.75	2.50
	C(I)	<0.10	2.75	2.75
	D(I)	<0.10	0.75	1.00
	E(I)	<0.10	0.65	1.75
	E(II)	1.30	2.50	2.50
	F(II)	1.20	3.75	4.00
	G(II)	1.50	3.25	3.00
	G(III) *	1.80	3.50	3.75
	G(IV)	3.50	4.50	4.50

* : Optimum reagent ratio.

product to support weight can be delayed 72 - 96 hours. No other change in physical or chemical character has been noted.

4. Physical Characteristics of CHEMFIX® Product

The four area composites and the total composite of CHEMFIX® products (at F(II) ratio with 15% water addition) were analyzed for UCS, permeability and bulk density. Table 9 summarizes the results. The CHEMFIX® product exhibited UCS of 3775 to 13535 lb/ft^2.[2] The permeability performed on the CHEMFIX® product was done by the triaxial procedure with flexible wall. No compaction to the cured material was applied. This procedure would simulate the actual field conditions much more closely than the procedure used for the untreated grit and screenings. The permeability results were at the 10^{-5} cm/sec. range. These high numbers might be due to the high pore volume of uncompacted grit and screenings after treatment. The bulk density ranged from 1.21 to 1.47 gm/cc. No major difference of density was observed for the CHEMFIX® products, compared to the density for the raw grit and screenings.

The composited sample was analyzed for total Kjeldahl nitrogen (TKN). The results showed very low TKN existing in the final CHEMFIX® product. Therefore, low ammonia odor generated from CHEMFIX® product in the field can be expected due to hydrolization.

TABLE 9.

PHYSICAL CHARACTERISTICS OF CHEMFIX PRODUCTS

PARAMETERS	CHEMFIX PRODUCTS	
	COMPOISTE	RESULTS
UCS (lb/sq.ft.)	Area 1	3775
	Area 3	7265
	Area 6	4795
	Area 7	13535
	Total	6115
Permeability (cm/sec)	Area 1	3.4×10^{-6}
	Area 3	2.2×10^{-5}
	Area 6	3.6×10^{-5}
	Area 7	2.4×10^{-5}
	Total	1.0×10^{-5}
Bulk Density (gm/ml)	Area 1	1.41
	Area 3	1.21
	Area 6	1.26
	Area 7	1.39
	Total	1.47
Total Kjeldahl Nitrogen (mg/kg)	Total (run 1)	95.2
	Total (run 2)	54.6

5. Microbiological Analysis

Total coliform and fecal coliform were analyzed as indicators for potential disease organisms. No fecal coliform was found in either raw material or CHEMFIX® product. There was 11,000 MPN/g of total coliform in the raw material. CHEMFIX® product with its inherent high pH is able to eliminate the total coliform as the results show in Table 10. Several studies have been performed by CTI concerning the disinfecting nature of CHEMFIX® process on municipal sludge. It was determined that the high pH can inactivate both bacteria and viruses in municipal sludge within one day; no regrowth was observed even after 60 days.

In this study, chlorinated primary effluent was used as process water and was added at 15% to improve the fixation efficiency. It was intended to use the effluent for the actual field processing. Therefore, the potential of re-contamination from the primary effluent to the grit and screenings with coliform bacteria, salmonella and viruses processing could be eliminated after CHEMFIX® process.

6. Metal Analyses

Total metal concentrations were determined for the total composited raw material and the total composite CHEMFIX® product. Two samples of each were run. In the raw composited material, lead

TABLE 10.

COLIFORM BACTERIA ANALYSES OF GRIT AND SCREENINGS
BEFORE AND AFTER CHEMFIX TREATMENT

PARAMETERS	COMPOSITED SAMPLE		CHEMFIX PRODUCT	
	RUN 1	RUN 2	RUN 3	RUN 4
Fecal Coliform (MPN/gm)	< 3	< 3	< 3	< 3
Total Coliform (MPN/gm)	11000	11000	< 3	3.6

April 6, 1987

PLAN OF STUDY FOR
CHEMFIX TREATMENT OF EXISTING GRIT AND SCREENINGS
DISPOSED ON DEER ISLAND

1.0 INTRODUCTION

MWRA's contractor, Camp Dresser & McKee (CDM), has prepared a report entitled "Field Investigations and Interim Closure Design Plan and Report for Grit and Screenings Disposal Areas on Deer Island (October, 1986). This report indicated that grit and screenings from the North System headworks have been disposed on Deer Island since the mid-1960's, in areas 1, 3, 6, and 7 indicated on the attached figure. As part of the activities required for the secondary treatment facilities planning project, the total volume of grit and screenings deposited in these areas has been estimated to be approximately 72,000 cu yd, based on the results of test pit surveys which were performed as part of the forgoing project. Interim closure of the existing grit and screenings disposal areas will be performed during 1987, and will consist of providing drainage improvements, grading of the disposal areas, and placement of temporary cover material on, and seeding the disposal areas.

Data which assess the chemical and physical characteristics of the contents of the grit and screenings disposal areas are unavailable. Groundwater quality data reported in the October, 1986 CDM report indicated that groundwater quality in the vicinity of the disposal areas has not been adversely affected. EP (extraction procedure)-toxicity analyses performed on fresh grit and screenings from North System headworks in 1981 indicated that these materials are not hazardous ("Interim Sludge Disposal Study," Stone & Webster Engineering Corporation, Inc., August, 1985).

To support planning of early site preparation activities for the secondary treatment facilities, evaluations will be performed to determine an acceptable, final disposal plan for the existing grit and screenings. This Plan of Study describes a data acquisition program which will provide information to permit an evaluation of CHEMFIX* treatment of the existing grit and screenings.

* CHEMFIX is a patented treatment process marketed by Chemfix Technologies, Inc.

The CHEMFIX process is a series of chemical reactions involving various combinations of chemical reagents, i.e., Portland cement and silica, with a waste material such as grit and screenings, which form a chemically and mechanically stabilized product. The CHEMFIX process has been reported to immobilize and convert potentially toxic heavy metals into less soluble and environmentally stable compounds, and inactivates and controls the regrowth of pathogenic microorganisms which may be contained within the untreated residuals.

A preliminary analysis was performed by Chemfix Technologies, Inc. (CTI), in October, 1986, to assess whether the accumulated grit and screenings in the disposal areas would be amenable to CHEMFIX treatment. Laboratory tests using CHEMFIX treatment were performed on a sample of grit taken from one of the disposal areas, as well as from fresh grit and screenings. Tests were performed using varying reagent ratios and dilutions with water and with scum from the Deer Island treatment plant. Results of this preliminary testing indicated that both fresh grit and screenings and grit from the disposal areas are amenable to CHEMFIX treatment, and produce a material suitable for beneficial reuse. The Executive Summary of CTI's October 29, 1986 report is included herein as Attachment A.

2.0 OBJECTIVES

The objectives of this investigation are as follows:

- To demonstrate in pilot-scale, the feasibility of CHEMFIX treatment of the grit and screenings contained within the disposal areas;
- To obtain CHEMFIX treatment process data which will permit a determination of costs, scheduling, utility, and operating requirements for treatment of the entire volume of the landfilled grit and screenings; and
- To describe the chemical and physical characteristics of CHEMFIX-treated grit and screenings for evaluating its environmental and structural suitability for final disposal on Deer Island.

3.0 SAMPLING GRIT AND SCREENINGS

The chemical and physical characteristics of the disposed grit and screenings may affect the CHEMFIX treatment process and the consistency of stabilized product. Consideration has

therefore been given to provide representative grit and screening samples for receiving CHEMFIX treatment testing.

It is anticipated that during final removal of material from the disposal areas for treatment, a range of mixtures of grit and screenings will be obtained reflecting their original placement within the disposal areas. Since specific information which would describe the placement of both grit and screenings within the disposal areas is unavailable, representative samples will be obtained by random selection of sample locations.

The total number of samples which will be taken for testing is 16, which provides for a minimum of two samples to be taken from each of the two smallest of the four disposal areas. All other samples are taken from the remaining disposal areas in direct proportion to the volume of grit and screenings which have been estimated in each area, as follows:

Area	Estimated Volume* of Grit & Screenings (cu yd)	No. of Samples Per Area
1	46,100	9
3	13,400	3
6	2,700	2
7	9,400	2

* The volumes of grit and screenings in the four disposal areas have been estimated based on the results of the 1986 CDM investigation.

The location of the grit and screenings samples are shown on Figure 5-1. Locations were selected by placing a grid over the disposal areas. Coordinates for sample locations were taken serially from a table of random numbers (Statistical Methods, G. W. Snedecor and W. G. Cochran, Iowa State University Press, sixth ed., 1967, p. 543) and located on the grid. Random number coordinates for locations outside of the disposal areas were rejected.

Sample locations will be marked in the field by making measurements from landmark structures. At each location, a backhoe will be used to remove any cover material, and a three to five foot deep trench will be excavated from the cleared area. Sample material will be removed from each trench by making a vertical slice with a shovel, from top to bottom of the trench. The sample will be removed from the trench and placed in a sealed plastic container. Sample locations will be marked by Stone & Webster Engineering Corporation, Inc. (S&W) field engineers. It is anticipated that available MWRA backhoe equipment on Deer Island will be

used for making sample trenches. All trenches will be backfilled with the excavated material after completion of sampling.

4.0 CHEMFIX TESTING

Unit operations in the full scale CHEMFIX process depend upon characteristics of the grit and screenings from the disposal areas. Based upon the preliminary characteristics data available, the CHEMFIX process is expected to consist of the following operations:

- o Material will be removed from the disposal areas and slurried with primary effluent.
- o Large particles in the slurried material will be reduced in size by shredding or grinding equipment.
- o CHEMFIX reagents, i.e., Portland cement and silicate, will be added to the slurried, reduced material and mixed in a pug mill or similar equipment.
- o The treated material is pumped or conveyed as a gel to the final disposal location for in-place curing.

CHEMFIX treatment testing will be performed on the samples removed from the disposal areas by simulating the above treatment processes. Treatment testing will be performed on the grit and screenings samples using equipment and procedures proprietary to CTI. Test runs will be performed on the full range of material mixtures observed in the samples to identify the following:

- o The volume of primary effluent required to slurry the grit and screenings;
- o Effective solids reduction technique, i.e., shredding or grinding;
- o Verification of optimum reagent ratios required for achieving a stabilized product.

CHEMFIX treatment testing performed to identify effective solids reduction technique will ensure that during full-scale treatment, all organic matter other than large stumps or scrap lumber (if present) will be reduced to a particle size consistent with effective stabilization. Treatment testing performed to identify slurry water requirements will ensure that during full-scale treatment, slurrying will be performed external to the disposal pits, and in a manner which will contain and control any runoff or drainage.

5.0 ANALYTICAL TECHNIQUE

Chemical and physical testing will be performed on untreated grit and screenings samples, and on CHEMFIX product samples, as described below. All sample shredding/grinding testing, and all analytical testing will be performed at CTI's facilities. Analytical methods which will be used are summarized in Table 5-1. The results of all analyses will be reported along with sample and composite sample identification to provide traceability to the original sample locations as shown on the attached figure. Quality assurance/quality control (QA/QC) procedures for both the field testing and laboratory testing activities will be documented by CTI and provided to Stone & Webster Engineering Corporation (S&W) for review and approval by the Division of Water Pollution Control and EPA prior to execution of this investigation.

<u>Analyses of Grit and Screenings Samples</u>

On representative subsamples from each of the 15 grit and screenings samples, bulk density, total solids, and volatile solids analyses will be performed.

A composite of the 15 grit and screenings samples will be made by taking approximately equal subsamples and mixing them together with a shovel. Duplicate analyses will be performed on a representative subsample of the composite grit and screenings for the parameters listed in Table 5-1. Tests for coliform bacteria and volatile organics will be on single, unreplicated subsamples.

<u>Analyses of CHEMFIX Process Variables</u>

To determine the ratio of CHEMFIX reagents most appropriate for the treatment of grit and screenings from the disposal areas, samples will be selected by CTI for CHEMFIX testing using variable reagent ratios. The resulting stabilized product samples will then be subjected to analysis to determine which of the ratio of reagents is most effective for stabilization. All subsequent testing will be based on the ratio determined in this step.

Results of CHEMFIX testing will also indicate the volume increase which will result from subjecting the grit and screenings to the CHEMFIX process.

<u>Analyses of Product Samples</u>

Samples of grit and screenings from four locations will be selected by CTI and CHEMFIX-treated using the optimum treatment conditions determined for slurry solution [illegible]

reduction, and reagent ratio. Following curing, each of the CHEMFIXed products will be analyzed for permeability, unconfined compressive strength, and bulk density. Two of the CHEMFIXed products will be selected by CTI for analysis of total Kjeldahl nitrogen, total metals, and EP-toxicity metals listed in Table 5-1; one of the CHEMFIXed products will be analyzed for total and fecal coliform bacteria.

6.0 REPORT

A report will be prepared by CTI which will include an Executive Summary, Introduction, Objectives, Sample Collection and Preparation, Treatment Testing Methodology, Results and Discussion, and Conclusion. The report will summarize and describe all observations and analytical results from this investigation, and include a cost estimate for full-scale CHEMFIX treatment of the entire contents of the grit and screenings disposal areas. The basis for the cost estimate shall be provided, including costs for labor, materials, and equipment; the report will document and describe the following:

- A description of equipment which would be used, and method of operation;
- Utility, primary effluent, and chemical requirements;
- Land requirements;
- Scheduling information including mobilization time, total time required for treatment (including a description of the changes to the treatment schedule if operation is not performed only during the winter period of November through March), and demobilization time;
- A description of procedures for removal of the grit and screenings from the disposal areas, and solids handling technique required for feeding the CHEMFIX process;
- Cost for CTI to perform the above grit and screenings removal and solids handling prior to CHEMFIX treatment;
- A description of product stockpiling and conveyance, and recommendations for subsequent handling.

The report will contain an evaluation by CTI of the potential benefits resulting from CHEMFIX treatment of the grit and screenings as they relate to control of leachate and its constituents (including pathogenic microorganisms) and improvements in material strength. The copy of literature

references required by CTI to document and justify this evaluation will be provided along with the draft report.

7.0 SCHEDULE

It is anticipated that, following a review and approval of this Plan of Study and of CTI's QA/QC procedures by the Division of Water Pollution Control, EPA, and others, testing will begin during the week of April 13, 1987, and will continue for 10 days. To support this starting date for the investigation, approvals of this Plan of Study and the QA/QC procedures must be received by April 2, 1987. Ten copies of a draft report for this investigation will be submitted by CTI to S&W by May 25, 1987. Twenty copies of a final report, which will contain resolution of comments from CDM, S&W, and others will be provided within ten days following receipt by CTI of comments on the draft report.

TABLE 5-1. ANALYSES PERFORMED ON GRIT AND SCREENINGS

Parameters	Analytical Methods: Grit and Screenings	CHEMFIX Product
Unconfined Compressive Strength	ASTM* D2820	ASTM D1633
Permeability	ASTM D2434	Falling Head Methods
Oil and Grease	SM** 503A	-
Total Solids	SM 209A	-
Total Volatile Solids	SM 209D	-
Total Metal Conc.:		
Arsenic	EPA***3050,7060	EPA 3050,7060
Barium	EPA 3050,7080	EPA 3050,7080
Cadmium	EPA 3050,7130	EPA 3050,7130
Chromium	EPA 3050,7190	EPA 3050,7190
Lead	EPA 3050,7420	EPA 3050,7420
Mercury	EPA 7471	EPA 7471
Selenium	EPA 3050,7740	EPA 3050,7740
Silver	EPA 3050,7760	EPA 3050,7760
EP-toxicity (above metals,only)	310 CMR 30.155	310 CMR 30.155
Total coliform bacteria	SM 908A	SM 908A
Fecal coliform bacteria	SM 908C	SM 908C
Volatile organics	EPA 624	-

* American Society for Testing and Materials

** Standard Methods for the Examination of Water and Wastewater, American Public Health Association. 16th edition, 1985

*** Test Methods for Evaluating Solid Wastes. SW-846. USEPA, 1982

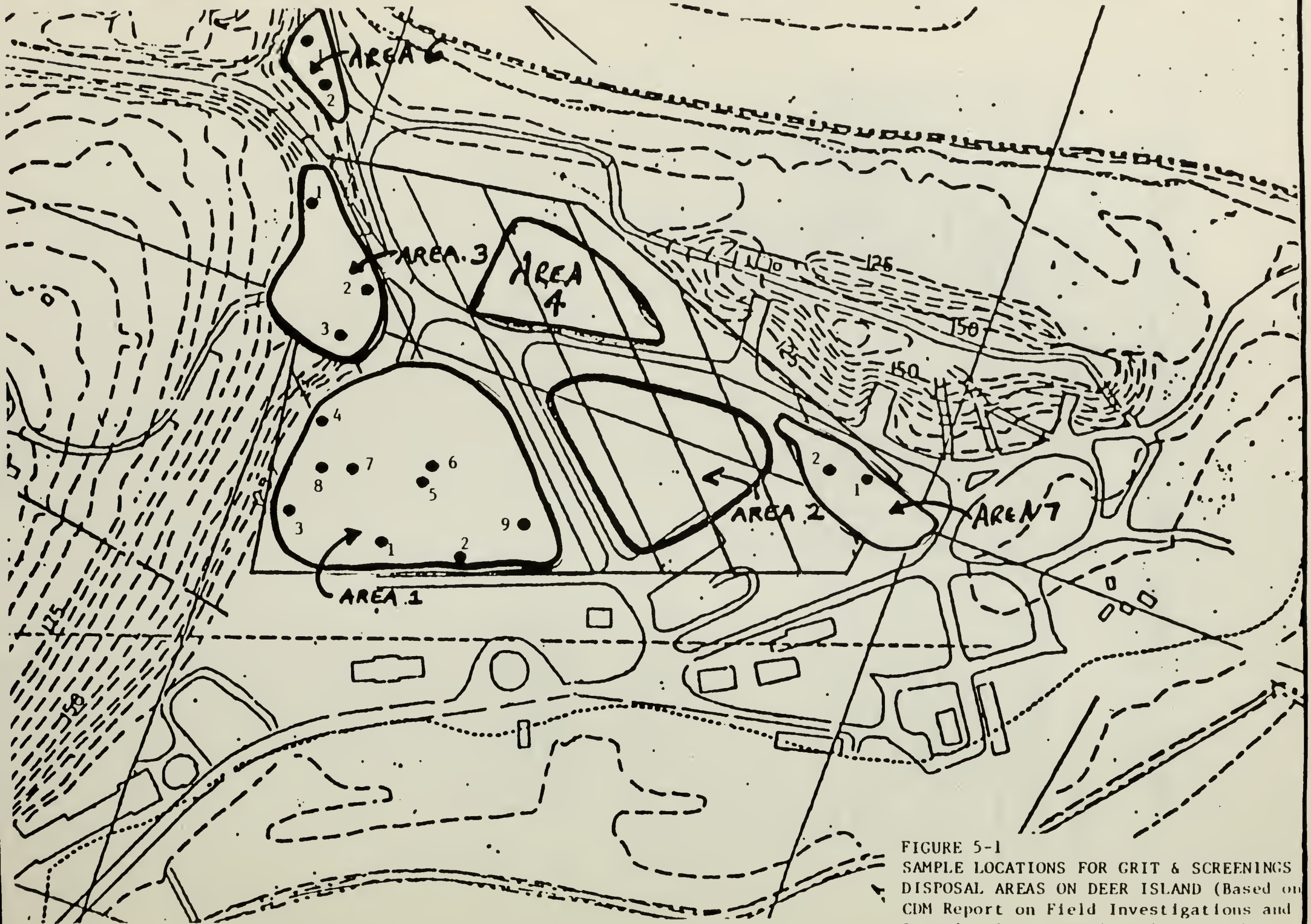

FIGURE 5-1
SAMPLE LOCATIONS FOR GRIT & SCREENINGS DISPOSAL AREAS ON DEER ISLAND (Based on CDM Report on Field Investigations and Interim Closure Design Plan, October, 1986).

Scale : 1" = 200'

ATTACHMENT

GRIT AND SCREENINGS TREATMENT BY CHEMFIX® PROCESS

- A BENCH SCALE STUDY

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October 29, 1986

EXECUTIVE SUMMARY

Chemfix Technologies, Inc. (CTI) and its subsidiary, Environmental Industrial Research Associates, Inc. (EIRA), were contracted by Camp, Dreser, and McKee, Inc. to conduct a bench scale study to determine the feasibility of treating concentrated MWRA grit and screenings from Deer Island addressing:

1. The daily production of grit and screenings from Winthrop Headworks.
2. The existing grit and screenings pile at the Deer Island facility.

Various modifications of the patented CHEMFIX® process were tested using the residuals from the Deer Island Wastewater Treatment Plant. The following highlights were evidenced by these studies.

- The CHEMFIX® process will treat headworks grit and screenings and landfill grit to produce an end-product suitable for use as daily cover or final cover at landfills in Massachusetts.

- CHEMFIX® treatment of grit and screenings will produce landfill quality material at only a 3.4 percent volume increase, thereby affording a treatment process which minimizes truck traffic required to transport the product off Deer Island.

- Scum produced at Deer Island can be mixed with grit and screenings before treatment. Treatment of this mixture using the CHEMFIX® process yields a product superior to treated scum without the grit and screenings.

- Material from the accumulated grit and screenings storage area can be treated using the CHEMFIX® process with a minimum water addition, producing a high quality landfill cover material.

APPENDIX B

ANALYTICAL DATA

ENVIRONMENTAL INDUSTRIAL RESEARCH ASSOCIATES, INC.
161 James Drive West, Suite 100
St. Rose, Louisiana 70087
(504) 469-0333

LABORATORY REPORT

Prepared for: Chemfix Technologies, Inc./Grit and Screening

Laboratory Number: 8705FK
Date Received: 05/06/87

Job Number: Not Supplied
Sampled By: Client

RESULTS

RAW DIGEST OF TOTAL COMPOSITE

Test	Concentration (mg/kg)	RDL (mg/kg)
Arsenic	0.60	0.10
Barium	193	5.0
Cadmium	5.49	0.25
Chromium	191	0.50
Lead	209	2.5
Mercury	1.51	0.020
Selenium	BDL	0.10
Silver	7.9	0.50
Oil and Grease (dry weight)	134,000	10
Oil and Grease (dry weight)	107,000 (duplicate)	10
Total Solids (%)	44	-

QUALITY CONTROL LAB BLANK

Test	Concentration (mg/l)	RDL (mg/l)
Arsenic	BDL	0.002
Barium	BDL	0.1
Cadmium	BDL	0.005
Chromium	BDL	0.05
Lead	BDL	0.05
Mercury	BDL	0.0002
Selenium	BDL	0.002
Silver	BDL	0.01

DUPLICATE RUN OF RAW DIGEST OF TOTAL COMPOSITE

Test	Concentration (mg/kg)	RDL (mg/kg)
Arsenic	2.51	0.103
Barium	122	5.29
Cadmium	7.09	0.26
Chromium	194	5.29
Lead	212	2.65

Lab Number: 8705FK

Mercury	0.285	0.013
Selenium	0.154	0.103
Silver	5.81	0.53

RDL: Required Detection Limit
BDL: Below Detection Limit
NOTE: Background correction used for Lead and Chromium analysis.

Client: CTI/Grit and Screening
Sample: Raw Digest of Total Composite

Date Extracted: N/A
Date Analyzed : 05/06/87

VOLATILE PRIORITY POLLUTANTS

Compound	Chromatographic Retention Time (min.)	Concentration (ug/kg)	RDL (ug/kg)
Chloromethane		BDL	5.0
Bromomethane		BDL	5.0
Trichlorofluoromethane		BDL	5.0
Vinyl Chloride		BDL	5.0
Chloroethane		BDL	5.0
Methylene Chloride	6.26	10 B	5.0
1,1-Dichloroethene		BDL	5.0
1,1-Dichloroethane		BDL	5.0
trans-1,2-Dichloroethene		BDL	5.0
Chloroform		BDL	5.0
1,2-Dichloroethane		BDL	5.0
1,1,1-Trichloroethane		BDL	5.0
Carbon tetrachloride		BDL	5.0
Bromodichloromethane		BDL	5.0
1,2-Dichloropropane		BDL	5.0
trans-1,3-Dichloropropene		BDL	5.0
Trichloroethene	16.48	5	5.0
Dibromochloromethane		BDL	5.0
1,1,2-Trichloroethane		BDL	5.0
Benzene	17.10	6	5.0
cis-1,3-Dichloropropene		BDL	5.0
2-Chloroethyl vinyl ether		BDL	5.0
Bromoform		BDL	5.0
Tetrachloroethene	22.26	37	5.0
1,1,2,2-Tetrachloroethane		BDL	5.0
Toluene	23.58	1400 (B=3.0)	5.0
Chlorobenzene	24.74	19	5.0
Ethyl Benzene	26.68	78	5.0

VOLATILE ORGANIC COMPOUNDS ADDITIONAL ANALYTES
HAZARDOUS SUBSTANCES LIST COMPOUNDS

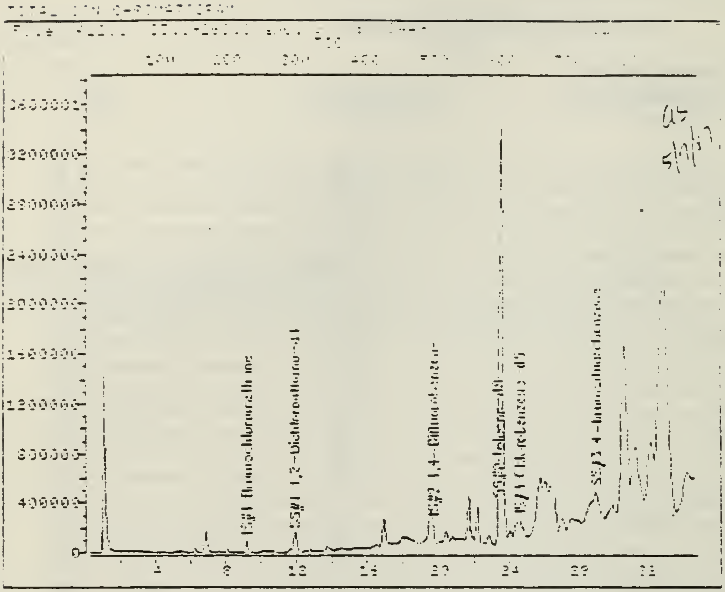
Compound	Chromatographic Retention Time (min.)	Concentration (ug/kg)	RDL (ug/kg)
Acetone	6.88	400 (B=14)	5.0
Carbon Disulfide	7.61	17	5.0
2-Butanone	11.99	220	5.0
Vinyl Acetate		BDL	5.0
2-Hexanone		BDL	5.0
4-Methyl-2-Pentanone		BDL	5.0
Styrene		BDL	5.0
Xylene (s) (total)	30.79-31.68	380	5.0

SURROGATE RECOVERY %

1,2-Dichloroethane 110
Toluene-d8 106
4-Bromofluorobenzene 82
Associated Blank: Blank #3

BDL: Below Detection Limit
RDL: Required Detection Limit
** : Below Report Limit, But Detected
B : Detected in Blank
MS : Matrix Spike Compound Level: ______

EIRA ENVIRONMENTAL INDUSTRIAL RESEARCH ASSOCIATES, INC.



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Name: G & S RD44-2
Misc: LOW SOIL 4.95 g 8705FK01

Id File: ID_V::D2
Title: HSL VOLATILE ORGANIC ANALYSIS EPA CLP APR86
Last Calibration: 870506 12:33

Operator ID: ANNETTE
Quant Time: 870506 18:19
Injected at: 870506 17:44

Client: CTI/Grit and Screening
Sample: Lab Blank #3

Date Extracted: N/A
Date Analyzed : 05/06/87

VOLATILE PRIORITY POLLUTANTS

Compound	Chromatographic Retention Time (min.)	Concentration (ug/kg)	RDL (ug/kg)
Chloromethane		BDL	5.0
Bromomethane		BDL	5.0
Trichlorofluoromethane		BDL	5.0
Vinyl Chloride		BDL	5.0
Chloroethane		BDL	5.0
Methylene Chloride	6.26	6	5.0
1,1-Dichloroethene		BDL	5.0
1,1-Dichloroethane		BDL	5.0
trans-1,2-Dichloroethene		BDL	5.0
Chloroform		BDL	5.0
1,2-Dichloroethane		BDL	5.0
1,1,1-Trichloroethane		BDL	5.0
Carbon tetrachloride		BDL	5.0
Bromodichloromethane		BDL	5.0
1,2-Dichloropropane		BDL	5.0
trans-1,3-Dichloropropene		BDL	5.0
Trichloroethene		BDL	5.0
Dibromochloromethane		BDL	5.0
1,1,2-Trichloroethane		BDL	5.0
Benzene		BDL	5.0
cis-1,3-Dichloropropene		BDL	5.0
2-Chloroethyl vinyl ether		BDL	5.0
Bromoform		BDL	5.0
Tetrachloroethene		BDL	5.0
1,1,2,2-Tetrachloroethane		BDL	5.0
Toluene	23.56	3 **	5.0
Chlorobenzene		BDL	5.0
Ethyl Benzene		BDL	5.0

VOLATILE ORGANIC COMPOUNDS ADDITIONAL ANALYTES
HAZARDOUS SUBSTANCES LIST COMPOUNDS

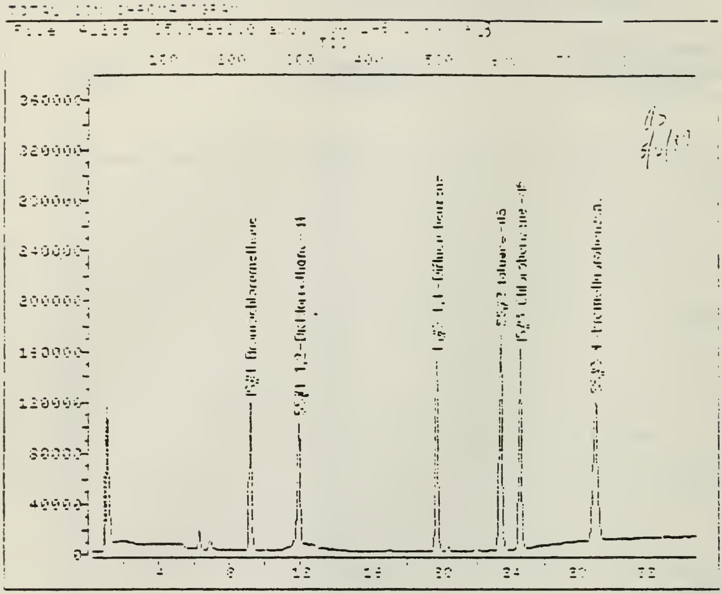
Acetone	6.91	14	5.0
Carbon Disulfide		BDL	5.0
2-Butanone		BDL	5.0
Vinyl Acetate		BDL	5.0
2-Hexanone		BDL	5.0
4-Methyl-2-Pentanone		BDL	5.0
Styrene		BDL	5.0
Xylene (s) (total)		BDL	5.0

SURROGATE RECOVERY	%
1,2-Dichloroethane	97
Toluene-d8	99
4-Bromofluorobenzene	100

Associated Blank: N/A

BDL: Below Detection Limit
RDL: Required Detection Limit
** : Below Report Limit, But Detected
B : Detected in Blank
MS : Matrix Spike Compound Level: ______

EIRA ENVIRONMENTAL INDUSTRIAL RESEARCH ASSOCIATES, INC.



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Name: VOA LAB BLANK # 3
Misc:

Id File: ID_V::D2
Title: HSL VOLATILE ORGANIC ANALYSIS EPA CLP APP3c
Last Calibration: 870506 12:33

Operator ID: ANNETTE
Quant Time: 870506 12:39
Injected at: 870506 10:39

ENVIRONMENTAL INDUSTRIAL RESEARCH ASSOCIATES, INC
161 James Drive West, Suite 100
St. Rose, Louisiana 70087
(504) 469-0333

METHODS

Inorganic Analyses on Water and Wastewater:

1. Standard Methods for the Evaluation of Water and Wastewater, APHA, AWWA, WPCF: 16th Edition.

Soils, Sediments and Hazardous Waste Evaluation Procedures:

2. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, U.S.E.P.A. Second Edition Revised April, 1984.

Organic Analyses on Water and Wastewater:

3. "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater", 40 CFR Part 136, Appendix A., U.S.E.P.A., Amended June 30, 1986.

John R. Troost,
Manager of Analytical Services

Date 6/1/87

Thomas E. Orr
Quality Assurance Manager

Date 5/29/87

ENVIRONMENTAL INDUSTRIAL RESEARCH ASSOCIATES, INC.
161 James Drive West, Suite 100
St. Rose, Louisiana 70087
(504) 469-0333

LABORATORY REPORT

Prepared for: Chemfix Technologies, Inc./Grit and Screening

Laboratory Number: 8705GK
Date Received: 05/12/87
Job Number: Not Supplied
Sampled By: Client

RESULTS

BLANK

Test	Concentration (mg/l)	RDL (mg/l)
Arsenic	BDL	0.002
Barium	0.1	0.1
Cadmium	0.009	0.005
Chromium	BDL	0.05
Lead	BDL	0.05
Mercury	0.0002	0.0002
Silver	BDL	0.01

EP LEACHATE FROM RAW TOTAL COMPOSITE

Test	Concentration (mg/l) in Extract	RDL (mg/l)
Arsenic	BDL	0.002
Barium	0.2	0.1
Cadmium	0.006	0.006
Chromium	BDL	0.05
Lead	BDL	0.05
Mercury	0.0010	0.0002
Selenium	BDL	0.002
Silver	BDL	0.01

QUALITY CONTROL LAB BLANK

Test	Concentration (mg/l)	RDL (mg/l)
Arsenic	BDL	0.002
Barium	BDL	0.1
Cadmium	BDL	0.005
Chromium	BDL	0.05
Lead	BDL	0.05
Selenium	BDL	0.002
Silver	BDL	0.01

RDL: Required Detection Limit
BDL: Below Detection Limit

EIRA ENVIRONMENTAL INDUSTRIAL RESEARCH ASSOCIATES, INC.

ENVIRONMENTAL INDUSTRIAL RESEARCH ASSOCIATES, INC
161 James Drive West, Suite 100
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(504) 469-0333

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Organic Analyses on Water and Wastewater:

3. "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater", 40 CFR Part 136, Appendix A., U.S.E.P.A., Amended June 30, 1986.

John R. Troost,
Manager of Analytical Services

Date 6/1/87

Thomas E. Orr,
Quality Assurance Manager

Date 5/29/87

ENVIRONMENTAL INDUSTRIAL RESEARCH ASSOCIATES, INC.
161 James Drive West, Suite 100
St. Rose, Louisiana 70087
(504) 469-0333

LABORATORY REPORT

Prepared for: Chemfix Technologies, Inc./Grit and Screening

Laboratory Number: 8705HM Job Number: Not Supplied
Date Received: 05/19/87 Sampled By: Client

RESULTS

OPTIMUM CHEMFIX (R) PRODUCT 1

Test	Concentration (mg/kg)	RDL (mg/kg)
Arsenic	3.53	0.53
Barium	52.6	5.26
Cadmium	2.84	0.26
Chromium	74.2	2.63
Lead	89.4	2.63
Mercury	0.118	0.011
Selenium	1.16	0.10
Silver	5.79	0.53
Total Kjeldahl Nitrogen	95.2	0.05
Total Kjeldahl Nitrogen (duplicate)	54.6	0.05

BLANK

Test	Concentration (mg/l)	RDL (mg/l)
Arsenic	0.04	0.01
Barium	BDL	0.002
Cadmium	0.009	0.005
Chromium	BDL	0.05
Lead	BDL	0.05
Mercury	BDL	0.0002
Selenium	BDL	0.002
Silver	0.04	0.01

EP LEACHATE 1 FROM OPTIMUM CHEMFIX (R) PRODUCT

Test	Concentration (mg/l) in Extract	RDL (mg/l)
Arsenic	0.026	0.002
Barium	0.3	0.1
Cadmium	0.010	0.005
Chromium	BDL	0.05
Lead	BDL	0.05
Selenium	0.017	0.002
Silver	0.03	0.01

EP LEACHATE 1 FROM OPTIMUM CHEMFIX (R) PRODUCT (DUPLICATE)

Test	Concentration (mg/l) in Extract	RDL (mg/l)
Arsenic	0.026	0.002
Barium	0.3	0.01
Cadmium	0.019	0.005
Chromium	BDL	0.05
Lead	BDL	0.05
Mercury	BDL	0.0005
Selenium	0.019	0.002
Silver	0.04	0.10

EP LEACHATE 1 FROM RAW TOTAL COMPOSITE (DUPLICATE)

Test	Concentration (mg/l) in Extract	RDL (mg/l)
Arsenic	0.013	0.002
Barium	0.8	0.1
Cadmium	0.023	0.005
Chromium	BDL	0.05
Lead	0.10	0.05
Mercury	0.0024	0.0005
Selenium	BDL	0.002
Silver	0.01	0.01

OPTIMUM CHEMFIX (R) PRODUCT 1 (DUPLICATE)

Test	Concentration (mg/kg)	RDL (mg/kg)
Arsenic	1.89	0.11
Barium	64.2	5.3
Cadmium	3.10	0.27
Chromium	82.9	2.68
Lead	112	2.68
Mercury	0.247	0.010
Selenium	0.945	0.11
Silver	4.28	0.54

OPTIMUM CHEMFIX (R) PRODUCT 2

Test	Concentration (mg/kg)	RDL (mg/kg)
Barium	63.1	5.26
Cadmium	2.89	2.63
Chromium	79.4	2.63
Lead	94.7	2.63
Mercury	0.250	0.011
Silver	4.06	0.53

BLANK

Test	Concentration (mg/l)	RDL (mg/l)
Barium	BDL	0.1
Cadmium	0.013	0.005
Chromium	BDL	0.05
Lead	BDL	0.05
Mercury	0.0028	0.0002
Silver	0.01	0.01

EP LEACHATE 2 FROM OPTIMUM CHEMFIX (R) PRODUCT

Test	Concentration (mg/l) in Extract	RDL (mg/l)
Barium	0.3	0.1
Cadmium	0.018	0.005
Chromium	0.06	0.05
Lead	BDL	0.05
Mercury	0.0032	0.0005
Silver	0.03	0.01

EP LEACHATE 2 FROM OPTIMUM CHEMFIX (R) PRODUCT DUPLICATE

Test	Concentration (mg/l) in Extract	RDL (mg/l)
Barium	0.2	0.1
Cadmium	0.023	0.005
Chromium	BDL	0.05
Lead	BDL	0.05
Mercury	0.0040	0.0005
Silver	0.03	0.01

EP LEACHATE 2 FROM RAW TOTAL COMPOSITE (DUPLICATE)

Test	Concentration (mg/l) in Extract	RDL (mg/l)
Barium	0.7	0.1
Cadmium	0.031	0.005
Chromium	0.05	0.05
Lead	0.08	0.05
Mercury	0.0060	0.0005
Silver	0.01	0.01

OPTIMUM CHEMFIX (R) PRODUCT 2 (DUPLICATE)

Test	Concentration (mg/kg)	RDL (mg/kg)
Barium	80.1	5.3
Cadmium	3.63	0.27
Chromium	78.2	2.68

Lead	121	2.68
Mercury	0.272	0.010
Silver	4.71	0.54

RDL: Required Detection Limit
BDL: Below Detection Limit

ENVIRONMENTAL INDUSTRIAL RESEARCH ASSOCIATES, INC
161 James Drive West, Suite 100
St. Rose, Louisiana 70087
(504) 469-0333

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Organic Analyses on Water and Wastewater:

3. "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater", 40 CFR Part 136, Appendix A., U.S.E.P.A., Amended June 30, 1986.

John R. Troost,
Manager of Analytical Services

Date 6/5/87

Thomas E. Orr
Quality Assurance Manager

Date 5/1/87

ENVIRONMENTAL INDUSTRIAL RESEARCH ASSOCIATES, INC.
161 James Drive West, Suite 100
St. Rose, Louisiana 70087
(504) 469-0333

LABORATORY REPORT

Prepared for: Chemfix Technologies, Inc./Grit and Screening

Laboratory Number: 8705IN
Date Received: 05/26/87
Job Number: Not Supplied
Sampled By: Client

RESULTS

LOCATION 7 RAW MATERIAL

Test	Concentration (mg/l)	RDL (mg/l)
Total Kjeldahl Nitrogen	176	0.5

LOCATION 7 EP EXTRACT

Test	Concentration (mg/l) in Extract	RDL (mg/l)
Arsenic	0.031	0.002
Barium	0.4	0.1
Cadmium	BDL	0.005
Chromium	BDL	0.05
Lead	0.06	0.05
Mercury	0.0020	0.0004
Selenium	BDL	0.002
Silver	0.03	0.01

LOCATION 7 EP EXTRACT DUPLICATE

Test	Concentration (mg/l) in Extract	RDL (mg/l)
Arsenic	0.008	0.002
Barium	0.3	0.1
Cadmium	BDL	0.005
Chromium	BDL	0.05
Lead	BDL	0.05
Mercury	0.0014	0.0004
Selenium	BDL	0.002
Silver	0.03	0.01

LOCATION 7 SPIKE

Test	Concentration (mg/l)	RDL (mg/l)
Arsenic	0.930	0.020
Barium	1.1	0.1
Cadmium	0.980	0.005

Chromium	0.98	0.05
Lead	1.00	0.05
Mercury	1.25	0.020
Selenium	0.960	0.040
Silver	0.10	0.01

QUALITY CONTROL LAB BLANK

Test	Concentration (mg/l)	RDL (mg/l)
Arsenic	BDL	0.002
Barium	BDL	0.01
Cadmium	BDL	0.005
Chromium	BDL	0.05
Lead	BDL	0.05
Mercury	0.0008	0.0002
Selenium	BDL	0.002
Silver	BDL	0.002

RDL: Required Detection Limit
BDL: Below Detection Limit

ENVIRONMENTAL INDUSTRIAL RESEARCH ASSOCIATES, INC
161 James Drive West, Suite 100
St. Rose, Louisiana 70087
(504) 469-0333

METHODS

Inorganic Analyses on Water and Wastewater:

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John R. Troost, Manager of Analytical Services — Date 6/17/87

Thomas E. Orr, Quality Assurance Manager — Date 6/17/87

CAL /Central Analytical Laboratories, Inc.
2600 Marietta Avenue, Kenner, Louisiana 70062
504/469-3511

REPORT OF ANALYSIS

Submitted By:	Chemfix Technologies	Date Completed:	5/08/87
Sample:	RD44-1	Date Received:	5/05/87
Lab No.:	E2618	CAL Number:	5620

Method of Analysis:

A.P.H.A. & B.A.M.

**************************** R E S U L T S ***************************

Sample Description	Coliforms (mpn/g)	Fecal Coliforms (mpn/g)
RD441	1,100	< 3
RD441 (Duplicate)	1,100	< 3

CENTRAL ANALYTICAL LABORATORIES, INC.

Signed Gerald J. Maus

Gerald J. Maus, PhD

CAL /Central Analytical Laboratories, Inc.
2600 Marietta Avenue, Kenner, Louisiana 70062
504/469-3511

REPORT OF ANALYSIS

Submitted By:	Chemfix Technologies	Date Completed:	5/21/87
Sample:	Mud	Date Received:	5/18/87
Lab No.:	E2749	CAL Number:	5683

Method of Analysis:

A.P.H.A. & B.A.M.

**************************** R E S U L T S ***************************

Sample Description	Coliforms (mpn/g)	Fecal Coliforms (mpn/g)
Mud (1st run)	< 3	< 3
Mud (2nd run)	3.6	< 3

CENTRAL ANALYTICAL LABORATORIES, INC.

Signed Gerald J. Maus

Gerald J. Maus, PhD

EUSTIS ENGINEERING
GEOTECHNICAL ENGINEERS
3011 28th Street • Metairie Louisiana 70002 • 504-834-0157

29 June 1987

Environmental Industrial Research Associates, Inc.
161 James Drive West
St. Rose, Louisiana 70087

Gentlemen:

Laboratory Test Results
Environmental Industrial Research Associates, Inc.

In accordance with your instructions, we have performed laboratory tests on samples submitted by your firm. The results of these tests are shown on the enclosures.

If we may be of further assistance to you, please contact us.

Yours very truly,

EUSTIS ENGINEERING

Lloyd A. Held

Lloyd A. Held, Jr.

S. Elkins:ln

Enclosure

SUMMARY OF LABORATORY PERMEABILITY TESTS

Sample Number	Classification	Moisture Content Percent		Density PCF		Coefficient of Permeability cm/sec at 20°C
		Initial	Final	Dry	Wet	
1A	Raw material	29.6	38.9	70.7	91.6	1.4×10^{-7}*
1B	Raw material	33.1	42.2	68.2	90.8	2.1×10^{-7}*
Total Composite	Chemfix prepared sample	58.1	62.9	54.0	85.4	1.0×10^{-5}**
Location No. I	Ditto	65.0	68.9	52.5	86.7	3.4×10^{-6}**
Location No. III	Ditto	62.1	68.6	52.3	84.7	2.2×10^{-5}**
Location No. VI	Ditto	69.5	74.9	49.1	83.3	3.6×10^{-5}**
Location No. VII	Ditto	47.5	52.2	63.5	93.7	2.4×10^{-5}**

*Test specimen were molded in the double ring permeameter at the estimated optimum moisture content using the standard ASTM D 698 compaction effort.

**Specimen were prepared by Chemfix and tests were performed in the flexible wall permeameter.

SUMMARY OF LABORATORY TEST RESULTS

Sample Number	Classification	Water Content Percent	Density PCF		Unconfined Compressive Strength PSF
			Dry	Wet	
1C	Raw material	30.2	73.9	96.2	3433*
1D	Ditto	29.5	77.7	100.6	2335*
Total Composite	Chemfix prepared sample	39.7	54.5	76.2	6115
Location No. I	Ditto	48.0	51.2	75.7	3775
Location No. III	Ditto	43.9	49.9	71.8	7265
Location No. VI	Ditto	57.7	40.1	63.2	4795
Location No. VII	Ditto	37.1	63.8	87.5	13,535

*Test specimen were molded at the estimated optimum moisture content using the standard ASTM D 698 compaction effort.

barium and chromium were present in the highest concentrations. Lead ranged from 209 mg/kg - 212 mg/kg, barium ranged from 122 - 193 mg/kg and chromium ranged from 191 -194 mg/kg. The remaining 5 metals tested were found at lower concentrations. These results are listed in Table 11. CHEMFIX® product had lower total metal contents than raw material. This may be due to the water and reagent addition during treatment which subsequently diluted the metal content.

Each material was then subjected to Extraction Procedure Toxicity Text (E.P.) to determine leachable metal concentrations Table 12 lists the results. The leachable metals were compared to the regulatory limits for hazardous characteristics as listed on the 40 CFR 261.24, 1986. The metal concentrations were well below the regulatory limits. Both the grit and screenings material before and after CHEMFIX® treatment should not be classified as hazardous under EP toxicity tests.

Although CHEMFIX® reagents, in particular the Portland cement, may contain trace levels of heavy metals, these metals have never been found to increase metal concentrations in CHEMFIX® product or leachate. Product and reagents have been stringently tested previously in relation to delisting work for hazardous waste. No additional metal concentrations were found as a result of CHEMFIX® reagents.

TABLE 11.

METAL CONCENTRATIONS OF GRIT AND SCREENINGS
BEFORE AND AFTER CHEMFIX TREATMENT

PARAMETERS	COMPOSITED SAMPLE		CHEMFIX PRODUCT	
	RUN 1	RUN 2	RUN 3	RUN 4
Arsenic (mg/kg)	0.60	2.51	3.53	1.89
Barium (mg/kg)	193	122	52.6	64.2
Cadmium (mg/kg)	5.49	7.09	2.84	3.10
Chromium (mg/kg)	191	194	74.2	82.9
Lead (mg/kg)	209	212	89.4	112.4
Mercury (mg/kg)	1.51	0.285	0.118	0.247
Selenium (mg/kg)	<0.10	0.15	1.16	0.95
Silver (mg/kg)	7.90	5.81	5.79	4.28

TABLE 12.

LEACHABLE METAL CONCENTRATIONS OF GRIT AND SCREENINGS
BEFORE AND AFTER CHEMFIX TREATMENT

PARAMETERS	COMPOSITED SAMPLE		CHEMFIX PRODUCT		REGULATORY LIMITS*
	RUN 1	RUN 2	RUN 3	RUN 4	
Arsenic (mg/l)	<0.002	0.013	0.026	0.026	5.0
Barium (mg/l)	0.2	0.8	0.3	0.3	100.0
Cadmium (mg/l)	0.006	0.023	0.010	0.019	1.0
Chromium (mg/l)	<0.05	<0.05	<0.05	<0.05	5.0
Lead (mg/l)	<0.05	0.10	<0.05	<0.05	5.0
Mercury (mg/l)	0.0010	0.0024	<0.0002	<0.0002	0.2
Selenium (mg/l)	<0.002	<0.002	0.017	0.019	5.0
Silver (mg/l)	<0.01	0.01	0.03	0.04	1.0

* : 40 CFR 260.24, 1986.

F. CONCLUSION

The CHEMFIX® process, incorporating the use of Portland cement and silicate solution, can treat the grit and screenings material from Deer Island very efficiently, producing material suitable for beneficial reuse. Grit and screenings from the landfill can be treated at F(II) ratio when 15% of water was added. A pretreatment of grit and screenings is needed by either grinder or shredder to reduce its size in order to be processed by CHEMFIX® equipment. The Ripshear® shredder utilized in the study showed excellent results in both shredding and through put rate.

After CHEMFIX® treatment, the final products showed significant improvement in strength and permeability, compared with field values anticipated for untreated grit and screenings. CHEMFIX® treatment also was observed to provide significant inactivation of bacteria contained in the grit and screenings.

CHEMFIX® treatment provided for acceptable metal concentrations in EP-leachate testing. Relative to metal concentration, sample inhomogeneity was observed for all grit and screenings samples; this prevented a direct comparison of the effects of CHEMFIX® treatment on leachable metals contained in the grit and screenings. However, based on the results of numerous similar tests performed by Chemfix Technologies, Inc. for municipal wastewater treatment sludges, improvement in metal leachability of CHEMFIX®-treated grit and screenings would be expected.

G. RECOMMENDATION

Due to the inhomogeneity of grit and screenings samples collected from Deer Island, it is recommended that each individual sample be analyzed for metal content and other appropriate constituents to establish a base line range of information at each grit and screenings disposal area. In addition, each sample would be subjected to the CHEMFIX® process at the predetermined ratio, followed by testing for its stability. This information would provide much higher statistical significance as to the projected future field treatment results.

V. ENGINEERING EVALUATION OF GRITS & SCREENING TREATMENT BY CHEMFIX® PROCESS

A. INTRODUCTION

Upon completion of the feasibility study, an effort was made to evaluate the actual treatment of the grit and screenings material by CHEMFIX® mobile treatment units. The following process, equipment and cost estimation were based on the estimated 72,000 cubic yards of grit and screening as outlined in the plan of study dated April 6, 1987. (Appendix A)

B. DESCRIPTION OF EQUIPMENT AND PROCESS

1. Grinding/Shredding Equipment

The shredder utilized in the bench scale study was hydraulically powered machine. Chemfix Technologies, Inc. will choose a machine of its kind based on availability and cost during the actual treatment. The shredder will be placed ahead of the CTI's pugmill. The grit and screenings will be excavated out and dropped into the shredder by way of conveying belt or bull dozer. Finally, the shredded material will then be conveyed to the pugmill for processing.

A significant feature of this hydraulically powered machine is that the power developed can be readily controlled using the pressure

relief valve on the hydraulic system. Thus, when an unusual object is encountered and there is no advantage to its being processed, the machine will stop. In doing so, the risk of damage is virtually eliminated. In order to compensate for what could possibly evolve into excessive downtime, there is a built in auto reverse cycle to clear itself. Only after several unsuccessful attempts will the unit shut down entirely and wait for someone to manually clear it. These auto reverse cycles are microprocessor controlled. The sequencing must occur properly and pressure reductions, fluid flow loss are determined before any switching takes place. These controls can readily be interlocked to the controls on our Acrison feeder to stop reagent feed when product flow is stopped.

2. CHEMFIX® Process Equipment and Operation

The proposed CHEMFIX® system will process and treat an estimated 200 cubic yards per day in 6-10 operating hours. The system will utilize a CTI mobile treatment system, modified to accommodate specific site and process considerations at Deer Island.

The processing system consists of a dry reagent storage trailer (silo), with a 120,000 pound capacity, a liquid reagent tank with a nominal capacity of 10,000 gallons, a control skid containing all motor controls, instrumentation, the dry reagent feeder, liquid reagent recirculation and metering pumps, a mixing skid with a CTI designed pug mill (U.S. Patent No. 4471916) and a twenty ton

capacity grit and screenings storage and feed hopper. During normal operations, the silo will be positioned at a right angle to the control skid and electrically interlocked with the control system. Level sensors on the intermediate hopper on the feeder control the transfer of dry reagent from the silo to the feeder. At the main control panel adjacent to the feeder, the operator controls the respective feed ratios of both reagents. The dry reagent is metered by the feeder into the pug mill mounted on the mixing skid located adjacent and parallel to the control skid. The primary effluent which will be used to dilute the material will be fed at approximately 10 gpm.

Flow of grit and screenings to the pug mill is controlled by the unit operator. As the material passes over an incline scale mounted in the transfer conveyor between the feed hopper/grinder and the process unit an instantaneous readout of material flow in tons per hour is produced along with a four to twenty milliamp signal which the control system uses to adjust reagent feed rates proportional to the indicated flow. The signal is simultaneously integrated to give a display of the total tons processed. The load cells and totalizer are calibrated and tested by a factory technician before a start up. The dry reagent is introduced into the pug mill, near the locations where the waste enters, to insure thorough mixing. The liquid reagent is then added to this mixture after the addition of the dry reagent, but prior to the mixture exiting the pug mill. The processed material is then discharged to

the containers or trucks supplied by the MWRA for hauling to the final disposal site.

Although material can be handled at any time, there is a 24 hour holding time prior to handling sample. During this time, the pH is monitored to insure pathogen inactivation. Final CHEMFIX® product is a stable material which resembles a silty clay. The material can be moved with conventional equipment used at a landfill. The product can be spread at any thickness required without causing difficulty.

a. CTI Equipment

1 - CTI Mobile Process System

1 - Liquid Reagent Storage Tank(s)

1 - Office, Lab, Maintenance Trailer

1 - Company Automobile

1 - Welding Machine

1 - High Pressure Water Blaster

1 - Lot First Aid Equipment

During the mobilization period, final equipment lists are developed for each project. Specific pieces of equipment and final site configuration are the responsibility of CTI's designated Project Manager. The above list is not intended to be all inclusive and CTI reserves the right to change equipment or systems.

b. Services Provided by MWRA

1) Excavated grit and screenings will be discharged into the CTI feed hopper by MWRA at a rate of 15-30 tons per hour depending on material inventory and CTI production rate. Nominal hours are 7:00 a.m. - 6:00 p.m., Monday through Saturday.

2) Receipt, loadout and hauling of CHEMFIX® product to the final disposal site.

3) Electric Service - 480 volt, 3 phase, 60 Hz service terminated at GCUA supplied breaker. The total connected horsepower will be between 250 and 300 HP. Location to be mutually determined by MWRA and CTI.

4) Water (Primary effluent for process & potable for cleanup) - 2" line, 60 psi, with valved connections. Location to be mutually determined by CTI and MWRA.

5) Site access for CTI personnel and suppliers seven days a week approximately 12 - 24 hours per day.

6) Security - 24 hours per day.

7) Access to sanitary facilities.

8) Telephone line at CTI process system.

9) Maintenance of access roads to and around process equipment. Reagent delivery trucks have a gross weight of 80,000 pounds. It is anticipated that 5 - 10 reagent delivers will be made each week.

10) Work area approximately 100′ x 200′ with road access for CTI personnel, suppliers, and subcontractors. Six (6) Chemfix employees will be on site.

CTI will require approximately 3 - 5 months advance notification to procure long lead items for the project. It will take approximately one week to transport equipment from St. Rose, Louisiana to Boston and additional one to two weeks at Deer Island to assemble, test and calibrate process equipment. It is presently CTI's plan to process through the winter. Upon completion of the project, demobilization and transfer of equipment back to Louisiana will take approximately two weeks.

C. COST ESTIMATE

Chemfix Technologies, Inc. can only provide a "ball park" cost estimate based on the limited information provided up to date. Several assumptions were made in order to generate the following table:

ITEM	COST/YARD^3
Mobilization/Demobilization	$ 1.09
Labor	7.19
Process Unit	1.38
Combination Office/Lab Trailer	.77
Capital Cost	1.94
Truck and Car	.58
Operating Expenses	1.33
Design & Engineering Cost	.29
Operations Management	.69
Grinder/Shredder	3.82
QA/QC	.69
Reagents	21.12
Total	$ 40.89

Based on the potential variation in the field, for processing only, the cost estimated will be $37.50 to $47.00 per yard. If CTI requires to excavate grit and screenings for processing and transport the CHEMFIX® product to the designated disposal area on Deer Island, a cost of $2.50 to $5.00 per yard should be added to the treatment cost.

The above estimated cost should only be used for budgetary purposes and should not be considered a firm price for the project. Chemfix Technologies, Inc. reserves the right to change the price for the processing.

REFERENCES

1. "Field Investigations and Interior Closure Design Plan and Report for Grit and Screenings Disposal Areas on Deer Island", Camp, Dresser, and McKee, Inc., Boston, Massachusetts, 1986.

2. "Grit and Screenings Treatment by CHEMFIX® Process - A Bench Scale Study". Chemfix Technologies, Inc., Metairie, Louisiana, 1986.

3. Lo, C.P., Metcalf, M.C., Reimers, R.S. and Akers, T.G.; 1987, "Chemical Stabilization - More Than A Fixation Process". Proceedings of the 42nd Annual Purdue Industrial Waste Conference, May, 1987.

4. Federal Register Vol. 51, No. 9, January 14, 1986.

5. Meehan, P.P., Reimers, R.S., Akers, T.G., Little, M.D., Metcalf, M.C., and Lo, C.P., 1986. "Development of Chemical Fixation Process to PFRP Classification for Municipal Sludge Treatment Enabling the Reuse of Resulting Product".

Appendix B

APPENDIX B

UNITED STATES DISTRICT COURT
DISTRICT OF MASSACHUSETTS

UNITED STATES OF AMERICA,
Plaintiff

Civil Action
85-0489-MA

Vs.

METROPOLITAN DISTRICT COMMISSION, et al.,
Defendants

CONSERVATION LAW FOUNDATION OF
NEW ENGLAND, INC.,
Plaintiff

Civil Action
83-1614-MA

Vs.

METROPOLITAN DISTRICT COMMISSION, et al.,
Defendants

LONG TERM SCHEDULING ORDER

Mazzone, D.J. May 8, 1986

An evidentiary hearing in this case was held on May 1 and 2, 1986, after the parties failed to agree upon proposed long term target dates for the completion of various steps necessary to the construction of the new sewage treatment facilities for Boston Harbor. These new facilities are being constructed pursuant to findings by this Court on September 5, 1985 that the defendants were in violation of Federal Clean Water Act standards. For years, Boston Harbor has been seriously and dangerously polluted. A brief review of the background of the disagreement as to long term dates is helpful to an understanding of the issues currently before the Court.

The parties initially filed proposed long term schedules in February, 1986. At that time, the Massachusetts Water Resources Authority ("MWRA") proposed a completion date for the secondary treatment facility in the year 2002. The Conservation Law Foundation ("CLF") proposed a completion date in 1996. The Environmental Protection Agency ("EPA") proposed a completion date in 1998. The MWR's initial schedule was based on an analysis prepared by its engineering consultants, Camp, Dresser & McKee ("CDM"). CDM, as part of its duties, had previously prepared a "critical path method" (CPD) flow chart, which, with the assistance of a computer, scheduled the myriad steps necessary to complete the project in the shortest possible time. While the other parties disagree as to the assumptions about duration and sequencing of tasks

made by CDM. CDM's critical path method, as revised, has been the yardstick against which the other schedules have been measured. Because the CMP is critical in planning and carrying out this complex project, it is important to understand what benefits it provides. Basically, it shows the starting date and completion date for activities to be performed on a project. It will depict (1) activities which precede other activities; (2) activities which must be performed concurrently; and (3) activities which must succeed other activities. It will usually assign four dates for each activity: early start, early finish and late start, late finish. For some activities, there is leeway or "float" in performance which will not affect overall project performance. The CPM is also important once work begins since it will provide, with necessary and continuous updates, early warnings of impending problems and delays. Finally, it can be used to justify or prove delay claims.

Despite ongoing negotiations between the parties, these dates remained the same until approximately two weeks ago. At that time, the EPA, CLF and the MWRA managed to agree on some, but not all, of the so-called "milestone" target dates. These milestone target dates will establish the start and finish dates for the following activities: facilities planning; site access; site development (Phasse I); primary plant construction; under harbor tunnel construction; new outfall construction; site development (Phase II); and secondary plant construction.

As a result of the parties' failure to agree upon all essential milestone target dates, an evidentiary hearing was scheduled. All parties including the City of Quincy, the Town of Winthrop, and the Boston Water and Sewer Commission were afforded an opportunity to present expert testimony concerning the appropriateness of proposed long term target dates. The subject matter of th hearing was expllicitly limited to such long term target dates. As a result, no evidence was presented on related issues such as sludge and scum discharges. All parties were given an opportunity to examine the expert witness called by the EPA, CLF, and the MWRA. The parties decided to rely upon their prior submissions on the issue of the financial implications of the different proposed schedules.

I.

Based on the submissions to date and the testimony offered at the hearing, I make the following general findings.

First, long term target deadlines are essential to the succesful clean up of Boston Harbor. Although my initial scheduling order in this case was entered a mere five months ago, it is already clear that specific dates must be established for each major step of this long and complex construction project. The parties must be held to a clear, understandable, and rational schedule. The Court and the public must be able to hold specific individuals and agencies responsible for accomplishing specific tasks within given time periods.

I also find that the target dates established today must be just that: target dates. The complexities of the construction project before the Court are vast in scope. There will, of course, be instances in which various specific deadlines will have to be altered due to circumstances unforeseeable at the moment. There will also be occasions on which specific

tasks can be completed more quickly than currently anticipated. Therefore, these target dates will be subject to review at the end of facilities planning. Nonetheless, target deadlines create a framework within which the parties may work together to accomplish the common goal. I also do not underestimate the importance of giving the citizens of this Commonwealth a public assurance that Boston Harbor will be cleaned up within a defined period of time.

Despite the negotiations between the parties in the last few weeks, and their agreement on certain dates, they have been unable to present to the Court a jointly proposed schedule of specific long term dates for the construction of the new treatment plants and related facilities. This Court has jurisdiction to protect the cleanliness of the Harbor and the safety of the citizens who enjoy and use that Harbor, even in the absence of an agreed schedule. Thus, given that the establishment of long term target dates is essential to the cleanup of the Harbor, I must set such dates at this time.

II.

Turning now to the evidence before me, I find that the financial considerations raised by the different proposed schedules are not determinative of the schedule selected. In particular, I accept the statements of John Petersen, the EPA's financial expert, that the MWRA's financial expert, Mark Ferber, greatly overestimates the difference between the financial impacts of the MWRA's proposed schedule and that of the EPA. I accept Mr. Petersen's statement that over fifty percent of the asserted difference in cost between the two schedules is attributable to operation and maintenance costs arising from earlier completion of the project. Earlier completion means earlier compliance.

I also agree with Mr. Petersen that the assumption made by the MWRA's expert that there will be a twenty percent reduction in the level of federal funding if the EPA's construction schedule is accepted is completely unfounded. While I have some concerns about Mr. Petersen's assumption that there will be no difference in the capital costs involved in any of the three schedules he analyzed, I have not been presented with sufficient evidence to the contrary to disbelieve him. I am also unpersuaded by Mr. Ferber's assumption that the capital requirements for constructing the new treatment facilities under the CLF schedule would be twenty percent greater than under the MWRA schedule.

Finally, I accept Mr. Petersen's statement that the market for tax exempt bonds in December 1985 was highly unusual due to bond buyers' anticipated concerns with impending federal tax reform efforts. Mr. Ferber's assumption that the MWRA would experience the same difficulties in marketing its bonds as were encountered by bond issuers in December 1985 is therefore inappropriate. The financial consultant retained by CLF also filed an affidavit in the case. His opinion that bond financing of this project within the next 10 to 12 years is possible, essentially supports Mr. Petersen's view and contradicts Mr. Ferber's view. Based on these affidavits, therefore, I find that the differences in cost associated with the different target completion dates is insufficient to affect my decision as to the appropriate long term construction target dates.

I turn now to the merits of the various schedules proposed by the parties.

a. MWRA's Proposed Schedule

As noted above, approximately two weeks ago the MWRA filed a report containing a revised construction schedule which accelerates the construction time table it originally proposed. Under the MWRA's new schedule, construction of the new primary components will be completed in 1994 and fully operational in 1995. Completion of construction of the secondary components is targeted for the year 1999. The proposed schedule requires completely "sequential" construction of the new primary and secondary plants. Sequential construction means that the new primary plant will be built in its entirety before any construction commences on the secondary plant.

Closely related to the "sequencing issue", as it has been referred to by the parties, is the thornier problem raised by the existence of the Deer Island House of Correction. The prison takes up a significant part of the very limited acreage available on Deer Island. The MWRA argues that the Deer Island House of Correction should be relocated both as a matter of building an environmentally sound plant and to comply with the determination that the removal of the prison is a mandatory mitigation measure under the Massachusetts Environmental Policy Act. The MWRA has asked to be allowed to report to the Court on the relocation issue in June 1986, and has urged the Court to take no action until then.

The MWRA opposes the positions of CLF and the EPA that the plant can be built in a shorter time period. Specifically, the MWRA states that CLF's schedule requires simultaneous construction of both the primary and secondary treatment facilities at the cost of an additional billion dollars. Further, it claims that CLF's schedule would delay primary plant operation by a year more than the MWRA's schedule. CLF's schedule would subject the neighboring Town of Winthrop to greater noise and other inconveniences due to the compressed construction schedule. CLF's proposed layout is extremely congested and unsafe from an engineering point of view, and the CLF schedule places almost all critical construction elements on the so-called "critical path" of construction.

The MWRA also opposes EPA's proposed schedule because it has almost all the same disadvantages as does CLF's schedule and ignores both the inter-relationship between construction and operation and the severe constraints on construction imposed by the New England climate and the smallness of the chosen site.

b. EPA's Proposed Schedule

The EPA, on behalf of the United States, has moved for target construction dates that would require completion of the secondary plant in the fourth quarter of 1997. The Government argues that the MWRA's original schedule was too long and allowed for almost a two-year delay between completion of the primary plant and commencement of secondary plant construction. The EPA has recently reached agreement with the MWRA on the timing of certain specific target dates namely those for pier and staging areas, commencement of primary treatment construction, and construction of the under-harbor tunnel. The EPA strongly disagrees with the MWRA's proposed completion date of 1999 for the secondary plant.

The EPA argues that the MWRA is short-sighted in failing to have a contingency plan in case the prison is not relocated in a timely fashion. The EPA is adamant that a contingency plan be included in facilities planning in case the prison is not removed in a timely manner. Since facilities planning was due to commence at the end of April 1986, it is important that facilities planners be informed immediately whether they must proceed with a contingency plan. The EPA therefore opposes the MWRA's motion to wait until June for a report on the contingency issue.

c. CLF's Proposed Schedule

CLF has filed its motion urging that the Court set target dates requiring completion of primary and secondary treatment facilities in 1996. The CLF schedule requires completely overlapping construction of the primary and secondary construction projects. CLF relies on its engineering consultants, James Colantonio, and Arturo Ressi di Cervia, for the proposition that there can be concurrent construction of the primary and secondary components of the plant. CLF argues that the MWRA has conceded that concurrent construction may be feasible, although the MWRA still claims that this is not "desirable." CLF argues that the Federal Water Pollution Control Act requires early compliance, not later compliance. Thus, if a remedy is feasible, it should be imposed. Finally, CLF claims that its schedule is manageable and will not result in a significantly less reliable treatment plant.

As an initial matter, I deny the MWRA's motion to strike the affidavits of Mr. Ressi and portions of the second affidavit of Mr. Colantonio. I find that the issues raised by the MWRA concerning their qualifications to testify go to the weight of their testimony, rather than to its admissability.

d. Other Parties

The Town of Winthrop and the City of Quincy both support the schedule proposed by the MWRA. Quincy takes the additional position, through its expert, David Standley, that firm scheduling dates are inappropriate at this time. Mr. Standley testified, nonetheless, that in his opinion the MWRA's schedule is better than the other proposed schedules because it stresses the importance of a plant that is reliable in the long term. Predictably, the defendants, Boston Water and Sewer Commission and the Commonwealth of Massachusetts, also support the MWRA's proposed schedule.

e. Specific Findings

The EPA, CLF and the MWRA each presented expert testimony concerning the engineering and construction implications of the various proposed schedules. The EPA relied on the testimony of Joseph F. Lagnese, Jr., a professor of engineering who has had extensive experience in the field of sewage and waste treatment engineering. Mr. Lagnese was a careful, articulate, and well-reasoned spokesman who supported the EPA's proposed construction schedule. He explained his reasons for believing that sequential construction was unnecessary and would waste much precious time. He further explained that he believed there was no question that the EPA's schedule could be met, and that challenges made to that schedule in the affidavits and

testimony of other experts were unfounded. He explained that he had used the same time durations for the construction elements of the secondary treatment plant as did CDM (EPA's engineering consultants) in its critical path method.

The primary means by which Mr. Lagnese's schedule advances completion over the MWRA's schedule is by compressing the length of time allotted to construction of the primary plant and by deleting much of the start up time allotted to bring the new secondary plant on-line after completion of construction. His proposed schedule would require fifteen months of construction during which both the primary and secondary plants would be under construction. Due to the foreseen complications of overlapping construction, he extended the estimated duration of secondary construction by ten months. In other words, his schedule allows for a 15 month overlap, resulting in a net gain of five months.

CLF presented its schedule through two different witnesses, James J. Colantonio, and Arturo Ressi di Cervia. Mr. Colantonio has been involved in waste treatment projects in various capacities for the last seventeen years. He was involved in one wastewater treatment project involving a 309 million gallons per day facility, but has not had significant, direct supervisory experience in constructing wastewater treatment plants of a size comparable to the plant proposed for Boston Harbor. Mr. Colantonio reviewed the scheduled durations originally prepared by CDM in its critical path method and changed only those durations that he felt were overly generous. Because neither he nor his firm has extensive experience in actual treatment plant construction, he consulted with Mr. Ressi for advice concerning excavation and concrete pouring.

Mr. Ressi, who received a Ph.D. in engineering from the University of Bologna, is currently the president of ICOS Corporation, a company that specializes in sophisticated excavation and concrete construction problems. Mr. Ressi was clearly familiar with the day to day mechanics of construction sites, and was the only construction expert who testified at the hearing. Because of this, and due to his general credibility, it is impossible to resist the conclusion that, as to the limited issues upon which he was competent to testify, his opinion must be respected. He was adamant that there is more than ample room on Deer Island for "staging areas" (that is, storage of construction materials and related support facilities for contractors located on site). Counsel for the MWRA attempted repeatedly to undermine his testimony in this regard, but to my mind unsuccessfully. Mr. Ressi has excavated and poured foundations for enough projects and in closer confines that those presented at Deer Island, to be a believable expert on the adequacy of staging areas. I also accept his testimony that there is a "zone of efficiency" in large construction projects, in other words, that certain tasks can and should be compressed in time so as to take advantage of efficiencies in scale. Nonetheless, I am unable to accept all of Mr. Ressi's testimony since he did not have, and did not pretend to have, any particular expertise concerning matters such as the mechanical, electrical, and piping portions of the new treatment plants. Further, he was clearly unfamiliar with, and unimpressed by, state and federal environmental regulations.

Thus, while I find that the testimony offered by the engineering and construction experts presented by the EPA and CLF have merit, I compare it to the testimony offered by the MWRA. The MWRA's consultant, Richard D. Fox, was clearly a qualified expert. Mr. Fox has had

extensive, direct contact with many large wastewater treatment plants. CDM, by whom he is employed, has also had extensive experience in the field and is considered a national expert on the subject of constructing major wastewater treatment facilities. Mr. Fox was clearly better qualified and more familiar with the intricacies of the existing construction schedule than any other expert at the hearing. He explained satisfactorily to the Court why the dangers of accelerated construction could outweigh the benefits to be gained by the advancement of two years over the EPA's schedule, and several years over the schedule of the CLF. Further, while I am somewhat curious about the recent advancement in the MWRA's proposed target dates, I nonetheless find that the MWRA has made very substantial efforts to show that it intends to complete the project at hand in as expeditious a manner as it believes consistent with good engineering practice.

In particular, I commend the advancement of the proposed construction date for the under-harbor tunnel by approximately four years. Mr. Fox explained initially that this change was a result of increased efficiencies made possible by the "phased" construction of the primary plant.[1] Under the phased construction method, part of the new primary plant will become operative earlier than the entire plant. Because of this earlier completion of part of the primary plant and the earlier scheduled completion of the new long outfall, sewage from Nut Island (which currently collects most of the sewage generated by communities located to the South of Boston) can be routed from Nut Island through the new under-harbor tunnel, directly out the new long outfall and into the deeper waters outside of Boston Harbor itself. This will have the benefit of eliminating direct discharges into the shallow waters of Quincy Bay, thus improving the water quality at the beaches and along the shorefront of inner Boston Habor.

The MWRA also agreed to a suggestion made by the EPA that Phase II site development (i.e. site development necessary to the construction of the secondary treatment plant) can and should be overlapped with primary plant construction. As a result of this concession, there is now no waiting time between the construction of the primary and secondary plants. Also as a result of

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[1] I note with concern Mr. Fox's second explanation for the shortening of the under-harbor tunnel construction project. He explained that as a result of "assurances" received from state and federal regulators concerning the possibility of non-complying discharges resulting from accelerating the tunnel project, the MWRA agreed to accelerate that project. Whatever Mr. Fox's understanding may be, compliance with interim limits does not mean that there would not have to be compliance with the Clean Water Act.

the testimony of both Mr. Fox and Mr. Ressi. this modification seems both reasonable and necessary. I can easily understand that it takes longer to build a plant in two phases. one component of which must become operational before the other. than it does to build it all at once.

I also agree with Mr. Fox's assertion that Mr. Lagnese's estimated time duration for the construction of the primary plant may be too compressed. Mr. Lagnese's testimony seemed to fail to take into account the scope and complexity of the proposed construction project. I am particularly impressed by the fact that despite Mr. Lagnese's compression of the duration. he also felt it necessary to extend the time allowed for secondary plant construction due to the "complexities" of compressed construction. As a result of fifteen months of concurrent construction between the primary and secondary plant construction phases. Mr. Lagnese's schedule would gain only five months towards the final completion of the project. Mr. Fox persuasively pointed out the flaws in Mr. Lagnese's schedule. and I am forced to accept his opinion.

I must also agree with Mr. Fox that the schedule proposed by CLF must be rejected. I do note. however. that CLF has been a constant and useful spur to the other parties in this action. Nonetheless. I agree with Mr. Fox that an overly compressed construction schedule will result in the long run in a plant that is less reliable and. consequently. expensive to maintain. This community has long suffered the effects of living with an unreliable sewage treatment system. Despite my inclination to expedite the process. I cannot avoid the more convincing evidence and impose a schedule that may haunt the citizens of the Commonwealth for the next fifty years or more.

In setting the long term dates that will guide the facilities planners. there is one guiding priority: that <u>all</u> steps that will result in the immediate improvement of the Harbor must be taken as expeditiously as possible. Given the parties' substantial agreement that the new primary plant will be operational by 1995. the citizens of the Commonwealth can rest assured that there will be substantial improvement in the water quality of the Harbor by then. I note that all the parties agree that the dates for the secondary treatment plant are not firm dates. In other words. while setting these dates will assist the facilities planners to schedule the construction projects. these dates. more than a decade in the future. do not set fixed deadlines. Accordingly. while I do not underestimate the importance of setting target dates for the secondary treatment components for the new plant. I am more concerned that the parties focus on the step that will lead towards the greatest immediate improvement of the Harbor's water quality. namely the completion of the primary plant.

The completion of the primary treatment plant. accompanied by the completion of the under-harbor tunnel will have an immense effect on the task at hand. That completion. in 1995. will end Nut Island outfall discharges in the shallow waters off Quincy. The increased capacity of the Deer Island primary plant will end the discharge of untreated sewage directly into the Harbor from Moon Island. a most serious problem. Increased capacity of Deer Island. together with the new outfall. will bring additional and substantial improvement. These are some immediate benefits apart from secondary treatment. While I believe the 1999 date for secondary treatment is supported by the more credible evidence at this time. I do not consider

it final. Further development in biological secondary treatment processes and advanced methods of treating wastes over the next five to ten years may alter drastically present day concepts of secondary treatment.

Finally, despite my general acceptance of the schedule proposed by the MWRA, I am not convinced that the schedule cannot be significantly accelerated. I also note that the proposed scheduling deadlines concern "major milestones." These dates do not determine the completion dates for many other, important steps that will have to be taken prior to the MWRA's ability to comply with federal water standards. Even by setting long term target dates at this time, this order does not begin to resolve the timing of other related problems, such as termination of sludge and scum discharges; establishment of interim effluent limits; infiltration/inflow control; and termination of discharges from the many combined sewage overflows ("CSOs") located around the harbor. I am particularly concerned about the CSO problem, since the CSOs are the source of a large portion of the raw sewage discharge in the delicate shallow waters nearest shore. The elimination of the CSO discharges will result in an immediate improvement in the water quality of Boston Harbor.

For these reasons, I adopt the following schedule of proposed target dates. The facilities planners should be instructed to proceed in accordance with these goals. They are urged to incorporate all possible expeditious measures in their plans. At the conclusion of facilities planning I will again review these dates and determine whether significant advancements can be made such as the overlapping of construction of the primary and secondary plants.

A. Design and Construction of Piers
and Staging Areas and Facilities Planning

On-Island

a.	Complete Design	December, 1987
b.	Bid Construction	May, 1988
c.	Award Construction	August, 1988
d.	Complete Construction	September, 1989
e.	Attain Operational Status	October, 1989

On-Shore

a.	Complete Design	January, 1988
b.	Bid Construction	June, 1988
c.	Award Construction	September, 1988
d.	Complete Construction	May, 1990
e.	Attain Operational Status	May, 1988

Complete Facilities Planning

B. Construction of Treatment Plant, Outfall and Under-Harbor Transmission Tunnel

Initiate construction of new primary treatment facilities	December, 1990
Complete construction and commence operation of new primary treatment facilities[2]	July, 1995

[2] "Complete construction and commence operation" means substantial completion of the primary facility, with the facility accepting expeditious process of start-up intended to achieve operation at primary treatment for all design flows within six months and full operation of the sludge digestion facilities within twelve months of the above date. The MWRA will evaluate, during facilities planning, the feasibility of completing a portion of the System flows at an earlier date, as well as a schedule for demolition of the existing Nut Island treatment plant. The MWRA will cease operations of the Nut Island treatment facility within six months following initiation of treatment of the South System flows at the New Deer Island primary facility.

Initiate construction of outfall[3]	July, 1991
Complete construction of outfall	July, 1994
Initiate construction of under-harbor transmission tunnel	April, 1991
Complete construction of under-harbor transmission tunnel[4]	December, 1994
Initiate construction of secondary treatment facilities	During 1995[5]
Complete construction of secondary	

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[3] The new outfall will accept flows from the existing Deer Island and Nut Island treatment facilities within three months of completion of the outfall or completion of the under-harbor transmission tunnel respectively.

[4] The new under-harbor transmission tunnel will accept flows from the existing Nut Island treatment facility for transfer to the new outfall within three months of completion of the tunnel; provided that the MWRA will, during facilities planning, evaluate the following water quality considerations applicable to the period between completion of the new outfall and tunnel and completion of the new primary plant. The MWRA will investigate during facilities planning the effects of accepting flows from the existing Deer Island and Nut Island facilities for discharge through the new outfall on the water quality of waters adjacent to the Town of Winthrop. The MWRA will conduct modelling studies during facilities planning which will include a demonstration that there will be no deterioration in the quality of such waters, in accordance with the applicable state water standards, as the result of discharge from the existing treatment plants through the new outfall.

[5] The MWRA will, during facilities planning, investigate and determine the extent to which construction of the secondary treatment components of the plant can be reasonably overlapped with the construction of the primary treatment components, in order to produce a plan which achieves secondary treatment in a reasonable and expeditious manner. During facilities planning the MWRA is also directed to investigate and evaluate "construction management" for the facilities construction program in order to provide a basis for determining its efficacy and cost for use in the program. The MWRA shall also take into account during facilities planning any schedule or plan furthering the objective to be specified in accordance with the Court's Third Monthly Compliance Order dated April 8, 1986.

treatment facilities[6]	DURING 1999

These are the target deadlines that the parties are ordered to utilize in their facilities planning. I urge the parties now, as I have done before, to continue to cooperate in expediting this project. They are encouraged, as always to seek early completion of the tasks scheduled.

For the reasons discussed in my prior Compliance Order Number 3, I reserve decision at this time on the prison relocation issue, although I must note that it is obvious that relocation of the prison is the crux of the scheduling issues.

SO ORDERED.

____

United States District Judge

[6]. "Complete construction and commence operation" means substantial completion of the secondary treatment facility, with the facility accepting flow. Substantial completion is expected to be followed by a period of start-up in order to consistently achieve secondary treatment twelve months following full start-up.

Appendix C

APPENDIX C

AMBIENT SOUND PRESSURE LEVELS,

SEPTEMBER 3, 1986, WINTHROP, MA

APPENDIX C

TABLE C-1

AMBIENT SOUND PRESSURE LEVELS,
September 3, 1986, Winthrop, MA

MEASUREMENT LOCATION (TIME OF SURVEY)	L90 dBA	RESIDUAL OCTAVE BAND CENTER FREQUENCY, HZ 31	63	125	250	500	1000	2000	4000	8000
1. Engineers House		Not Collected								
2. 150 Tafts (1300-1310)	45	Not Collected								
4. Tafts & Otis (1337-1347)	43	Not Collected								
5. Shirley & Triton (1450-1500)	44	Not Collected								
6. Siren & Triton (1414-1424)	40	Not Collected								
7. Harbor View (1500-1510)	42	Not Collected								

NOTE:

Weather conditions: Wind E, < 5 mph, overcast.

APPENDIX C

TABLE C-2

AMBIENT SOUND PRESSURE LEVELS, September 5, 1986, Winthrop, MA

MEASUREMENT LOCATION (TIME OF SURVEY)	L90 dBA	RESIDUAL OCTAVE BAND CENTER FREQUENCY, HZ 31	63	125	250	500	1000	2000	4000	8000
1. Engineers House			Not Collected							
2. 150 Tafts (1000-1015)	51	58	60[1]	63	53	42	37	33	28	25
4. Tafts & Otis (1037-1047)	43	55	55	50	41	38	38	30	30	17
5. Shirley & Triton (1053-1104)	42	55	58	51	49	45	40	32	27	20
6. Siren & Triton (1115-1126)	44	57	57	53	45	38	35	29	29	21
7. Harbor View (1139-1152)	49	61	60[2]	57	49	44	41	37	32	32

NOTES:

1 Diesels just audible, pulses to 70 dB.
2 Diesles audible, pulses to 65 dB.

Weather conditions: Winds Light, Southerly, Sky Clear.

APPENDIX C

TABLE C-3

AMBIENT SOUND PRESSURE LEVELS,
September 16, 1986, Winthrop, MA

MEASUREMENT LOCATION (TIME OF SURVEY)	L90 dBA	RESIDUAL OCTAVE BAND CENTER FREQUENCY, HZ								
		31	63	125	250	500	1000	2000	4000	8000
1. Engineers House (2200-2210)	53	60	65	60	56	56	49	44	38	27
2. 150 Tafts (2240-2250)	48		Not Collected							
4. Tafts & Otis (2300-2310)	47		Not Collected							
5. Shirley & Triton (2420-2430)	46		Not Collected							
6. Siren & Triton (2339-2349)	46		Not Collected							
7. Harbor View (2358-0008)	48		Not Collected							

NOTE:

Weather conditions: Winds N at 5 mph.

APPENDIX C

TABLE C-4

AMBIENT SOUND PRESSURE LEVELS, September 17-18, 1986, Winthrop, MA

MEASUREMENT LOCATION	L90	RESIDUAL OCTAVE BAND CENTER FREQUENCY, HZ								
(TIME OF SURVEY)	dBA	31	63	125	250	500	1000	2000	4000	8000
1. Engineers House (0030-0049)	47	60	65	56	51	43	40	27	33	19
2. 150 Tafts (0010-0024)	40	55	60[1]	53	42	35	29	22	18	15
4. Tafts & Otis (2355-0005)	38	51	52	49	41	36	29	22	15	14
5. Shirley & Triton (2338-2350)	42	55	55	56	49	39	34	26	22	15
6. Siren & Triton (2322-2333)	47	57	57	52	50	46	39	28	25	16
7. Harbor View (2304-2314)	48	53	61	52	45	41	38	38	32	20

NOTE:

[1] Diesels audible, level varies to 70 dB with pulses.
Weather conditions: Wind SW - Light to calm.

APPENDIX C

TABLE C-5

AMBIENT SOUND PRESSURE LEVELS,
September 18-19, 1986, Winthrop, MA

MEASUREMENT LOCATION	L90	RESIDUAL OCTAVE BAND CENTER FREQUENCY, HZ								
(TIME OF SURVEY)	dBA	31	63	125	250	500	1000	2000	4000	8000
1. Engineers House (0025-0036)	48	60	65[1]	57	47	42	37	32	28	18
2. 150 Tafts (2335-2345)	46	57	60[1]	54	46	40	36	32	28	23
4. Tafts & Otis (2314-2325)	42	56	58	55	44	38	34	27	26	18
5. Shirley & Triton (2242-2252)	44	57	57[2]	55	45	40	36	32	30	23
6. Siren & Triton (2250-2309)	43	56	59	51	45	40	34	28	30	22
7. Harbor View (2216-2227)	50	55	60	55	46	45	40	36	35	32

NOTES:

[1] Diesels audible, 70 dB peak.
[2] Perhaps, just audible.
Weather conditions: Wind SW very Light.

Appendix D

APPENDIX D

STATISTICAL AMBIENT SOUND LEVELS

POINT SHIRLEY, WINTHROP, MA

APPENDIX D

Statistical Ambient Sound Levels
Position 1: Engineer's House
Point Shirley, Winthrop, MA

DATE (1986)	TIME	dBA L10	dBA L50	dBA L90
01-Sep	17	63.5	56.5	51.5
01-Sep	18	63.0	56.5	51.5
01-Sep	19	62.5	56.5	51.0
01-Sep	20	62.0	55.0	50.0
01-Sep	21	66.0	58.0	50.5
01-Sep	22	66.0	51.0	46.5
01-Sep	23	59.0	47.5	44.5
01-Sep	24	52.0	44.0	42.5
02-Sep	1	54.0	45.5	42.5
02-Sep	2	48.5	42.5	40.5
02-Sep	3	52.5	42.0	39.0
02-Sep	4	53.0	41.5	38.0
02-Sep	5	51.5	43.0	37.0
02-Sep	6	58.0	44.0	39.0
02-Sep	7	76.5	62.0	47.0
02-Sep	8	70.5	52.0	46.5
02-Sep	9	71.5	54.0	48.5
02-Sep	10	72.0	53.0	48.0
02-Sep	11	72.0	50.0	45.5
02-Sep	12	71.5	51.5	46.5
02-Sep	13	73.5	52.0	47.0
02-Sep	14	67.5	50.0	47.0
02-Sep	15	72.0	50.0	46.0
02-Sep	16	70.5	50.0	44.7
02-Sep	17	73.0	49.0	43.0
02-Sep	18	74.0	51.5	44.0
02-Sep	19	70.0	50.0	45.5
02-Sep	20	70.5	49.0	46.0
02-Sep	21	74.0	51.5	47.5
02-Sep	22	73.0	51.0	46.5
02-Sep	23	71.5	48.5	46.0
02-Sep	24	49.0	46.5	45.5

APPENDIX D

Statistical Ambient Sound Levels
Position 1: Engineer's House
Point Shirley, Winthrop, MA
(continued)

	DATE (1986)	TIME	dBA L10	dBA L50	dBA L90
03-Sep	1	47.5	45.5	44.5	
	03-Sep	2	46.0	44.5	43.5
	03-Sep	3	45.0	44.0	43.0
	03-Sep	4	44.5	43.0	42.0
	03-Sep	5	44.0	42.5	41.5
	03-Sep	6	58.5	45.0	42.5
	03-Sep	7	76.5	55.0	45.5
	03-Sep	8	74.0	53.5	46.0
	03-Sep	9	75.0	55.5	46.5
	03-Sep	10	66.5	48.5	45.5
	03-Sep	11	73.0	51.0	45.5
	03-Sep	12	73.0	50.0	44.0
	03-Sep	13	77.5	54.5	46.0
	03-Sep	14	68.5	47.5	44.0
	03-Sep	15	77.5	51.5	44.5
	03-Sep	16	73.0	52.0	44.5
	03-Sep	17	77.5	54.0	44.0
	03-Sep	18	77.5	55.0	45.0
	03-Sep	19	77.5	58.0	45.5
	03-Sep	20	71.0	49.0	44.0
	03-Sep	21	73.5	52.0	43.5
	03-Sep	22	70.5	45.5	42.0
	03-Sep	23	58.0	42.5	39.5
	03-Sep	24	47.0	40.0	38.0
	04-Sep	1	47.0	39.0	37.5
	04-Sep	2	43.0	37.5	36.0
	04-Sep	3	42.5	36.0	35.0
	04-Sep	4	39.0	36.5	36.0
	04-Sep	5	45.0	42.0	39.0
	04-Sep	6	54.0	46.5	43.5
	04-Sep	7	61.0	55.0	48.5

APPENDIX D

Statistical Ambient Sound Levels
Position 1: Engineer's House
Point Shirley, Winthrop, MA
(continued)

DATE (1986)	TIME	dBA L10	dBA L50	dBA L90
04-Sep	8	61.0	54.0	48.5
04-Sep	9	62.0	54.0	49.0
04-Sep	10	61.5	52.5	47.5
04-Sep	11	74.5	59.5	41.0
04-Sep	12	74.5	60.0	52.5
04-Sep	13	74.0	56.0	51.5
04-Sep	14			
04-Sep	15	73.0	58.0	52.0
04-Sep	16	71.5	54.0	50.0
04-Sep	17	62.0	56.0	51.0
04-Sep	18	61.0	56.0	50.5
04-Sep	19	62.0	53.5	48.5
04-Sep	20	60.5	53.0	48.0
04-Sep	21	60.5	52.0	46.5
04-Sep	22	61.0	51.0	47.0
04-Sep	23	57.0	47.5	45.0
04-Sep	24	52.0	45.5	44.0
05-Sep	1	54.0	46.5	45.0
05-Sep	2	48.5	44.5	43.0
05-Sep	3	48.0	45.5	44.0
05-Sep	4	51.5	47.5	43.0
05-Sep	5	51.5	47.0	44.0
05-Sep	6	59.0	52.5	48.5
05-Sep	7	65.0	58.5	53.0
05-Sep	8	65.0	58.5	53.0
05-Sep	9	64.0	57.5	53.0
05-Sep	10	62.0	57.0	52.5
05-Sep	11	67.5	59.0	53.5
05-Sep	12	75.0	59.0	51.5
05-Sep	13	71.0	56.0	53.0
05-Sep	14	64.5	57.0	52.0

APPENDIX D

Statistical Ambient Sound Levels
Position 1: Engineer's House
Point Shirley, Winthrop, MA
(continued)

DATE (1986)	TIME	dBA L10	dBA L50	dBA L90
05-Sep	15	62.5	55.5	52.0
05-Sep	16	63.5	57.0	51.5
05-Sep	17	62.0	56.5	51.0
05-Sep	18	62.0	55.5	49.0
05-Sep	19	61.5	55.5	49.5
05-Sep	20	63.0	56.0	47.0
05-Sep	21	63.0	54.5	48.5
05-Sep	22	59.5	49.5	46.5
05-Sep	23	53.5	45.5	43.0
05-Sep	24	44.5	42.5	42.0
06-Sep	1	44.0	42.0	41.0
06-Sep	2	44.5	42.5	41.5
06-Sep	3	44.0	42.0	40.5
06-Sep	4	45.0	42.5	41.0
06-Sep	5	47.5	43.0	41.5
06-Sep	6	56.5	49.0	46.0
06-Sep	7	62.0	53.0	46.0
06-Sep	8	61.5	53.5	42.5
06-Sep	9	62.0	53.0	45.0
06-Sep	10	61.5	55.5	50.0
06-Sep	11	69.0	58.0	51.0
06-Sep	12	74.0	58.0	53.0
06-Sep	13	68.0	57.0	53.0
06-Sep	14	70.0	57.5	53.0
06-Sep	15	71.0	59.5	55.5
06-Sep	16	74.0	59.5	54.5
06-Sep	17	63.0	57.0	51.5
06-Sep	18	61.0	54.5	49.0
06-Sep	19	61.5	54.5	49.0
06-Sep	20	60.0	53.5	46.0
06-Sep	21	60.0	52.5	46.0

APPENDIX D

Statistical Ambient Sound Levels
Position 1: Engineer's House
Point Shirley, Winthrop, MA
(continued)

DATE (1986)	TIME	dBA L10	dBA L50	dBA L90
06-Sep	22	62.0	52.0	47.5
06-Sep	23	55.0	48.0	46.5
06-Sep	24	50.0	48.0	46.5
07-Sep	1	50.0	48.5	47.0
07-Sep	2	49.5	47.5	47.0
07-Sep	3	50.0	47.0	45.0
07-Sep	4	48.0	47.0	46.0
07-Sep	5	50.5	47.5	46.5
07-Sep	6	67.5	53.5	49.5
07-Sep	7	70.5	61.5	55.0
07-Sep	8	63.0	56.5	50.0
07-Sep	9	64.5	58.0	51.0
07-Sep	10	61.0	53.0	47.0
07-Sep	11	61.5	54.0	47.0
07-Sep	12	60.0	53.0	47.0
07-Sep	13	60.0	51.5	46.5
07-Sep	14	60.0	52.0	47.5
07-Sep	15	59.0	52.5	48.5
07-Sep	16	61.0	55.0	49.5
07-Sep	17	60.0	54.0	48.0
07-Sep	18	62.5	57.0	50.5
07-Sep	19	59.5	53.5	48.0
07-Sep	20	65.0	54.0	46.5
07-Sep	21	66.5	56.0	46.5
07-Sep	22	68.5	57.5	48.5
07-Sep	23	59.5	50.5	48.0
07-Sep	24	55.5	48.5	46.0
08-Sep	1	58.0	47.0	45.0
08-Sep	2	50.5	46.0	44.5
08-Sep	3	50.0	47.5	45.5
08-Sep	4	48.0	45.5	44.0

APPENDIX D

Statistical Ambient Sound Levels
Position 1: Engineer's House
Point Shirley, Winthrop, MA
(continued)

DATE (1986)	TIME	dBA L10	L50	L90
08-Sep	5	53.5	48.0	46.0
08-Sep	6	62.5	54.5	51.0
08-Sep	7	68.0	60.5	55.5
08-Sep	8	66.5	59.5	53.5
08-Sep	9	67.5	60.5	53.0
08-Sep	10	63.0	52.5	46.0
08-Sep	11	62.0	56.0	48.5
08-Sep	12	64.5	56.5	50.5
08-Sep	13	61.0	54.5	49.5
08-Sep	14	62.5	55.5	51.0
08-Sep	15	62.0	55.0	50.5
08-Sep	16	63.0	56.0	51.0
08-Sep	17	63.5	56.5	51.0
08-Sep	18	65.6	56.5	52.5
08-Sep	19	65.0	58.5	53.0
08-Sep	20	65.0	58.5	52.0
08-Sep	21	67.0	56.5	49.0
08-Sep	22	66.0	56.5	51.0
08-Sep	23	61.0	50.0	48.5
08-Sep	24	53.0	51.0	49.0
09-Sep	1	62.5	51.5	49.5
09-Sep	2	53.0	49.5	47.5
09-Sep	3	49.0	47.0	45.5
09-Sep	4	49.0	47.0	46.0
09-Sep	5	51.5	47.5	46.5
09-Sep	6	64.0	54.5	51.5
09-Sep	7	67.5	61.5	55.0
09-Sep	8	66.5	60.0	56.0
09-Sep	9	65.0	58.5	54.5
09-Sep	10	60.5	53.5	49.0
09-Sep	11	61.0	54.5	50.0

APPENDIX D

Statistical Ambient Sound Levels
Position 1: Engineer's House
Point Shirley, Winthrop, MA
(continued)

DATE (1986)	TIME	dBA L10	L50	L90
09-Sep	12	61.5	55.5	52.0
09-Sep	13	59.5	54.5	51.0
09-Sep	14	60.0	54.5	52.0
09-Sep	15	61.5	56.0	53.0
09-Sep	16	63.0	58.5	56.0
09-Sep	17	64.0	60.0	57.5
09-Sep	18	63.5	60.0	58.0
09-Sep	19	64.0	58.5	56.0
09-Sep	20	63.5	57.0	54.0
09-Sep	21	65.0	55.0	51.5
09-Sep	22	67.0	51.5	49.0
09-Sep	23	56.0	51.5	49.5
09-Sep	24	56.0	54.5	53.0
10-Sep	1	58.5	57.0	55.5
10-Sep	2	58.5	57.0	56.0
10-Sep	3	58.5	57.0	55.0
10-Sep	4	58.0	56.0	55.0
10-Sep	5	58.0	56.0	54.5
10-Sep	6	62.5	56.5	55.0
10-Sep	7	65.0	59.5	56.5
10-Sep	8	64.5	59.5	57.5
10-Sep	9	64.0	59.0	56.5
10-Sep	10	62.0	57.0	55.5
10-Sep	11	62.5	59.0	56.0
10-Sep	12	63.0	60.0	59.0
10-Sep	13	63.0	60.5	59.0
10-Sep	14	64.0	62.0	60.0
10-Sep	15	63.5	60.5	58.5
10-Sep	16	64.0	60.5	58.5
10-Sep	17	64.0	60.5	58.0
10-Sep	18	64.5	60.5	58.0

APPENDIX D

Statistical Ambient Sound Levels
Position 1: Engineer's House
Point Shirley, Winthrop, MA
(continued)

DATE (1986)	TIME	dBA L10	dBA L50	dBA L90
10-Sep	19	64.5	60.0	57.5
10-Sep	20	64.5	58.5	56.0
10-Sep	21	65.0	58.5	56.0
10-Sep	22	63.0	56.5	54.0
10-Sep	23	59.0	54.0	52.0
10-Sep	24	57.5	56.0	54.5
11-Sep	1	59.0	58.0	56.5
11-Sep	2	58.5	57.5	56.5
11-Sep	3	59.5	58.0	57.0
11-Sep	4	58.0	57.0	56.0
11-Sep	5	58.5	57.0	55.5
11-Sep	6	61.0	56.5	54.5
11-Sep	7	64.5	60.5	58.0
11-Sep	8	65.0	61.0	59.5
11-Sep	9	65.0	61.0	59.5
11-Sep	10	63.5	60.0	58.0
11-Sep	11	64.0	60.0	57.5
11-Sep	12	63.5	58.5	56.5
11-Sep	13	64.5	60.0	58.0
11-Sep	14	62.5	59.5	58.0
11-Sep	15	63.0	59.0	57.0
11-Sep	16	63.5	59.0	56.5
11-Sep	17	64.0	58.0	55.0
11-Sep	18	64.0	58.5	56.0
11-Sep	19	68.0	60.0	56.0
11-Sep	20	65.0	58.0	53.5
11-Sep	21	66.0	60.0	54.5
11-Sep	22	65.5	59.5	53.0
11-Sep	23	64.5	55.0	51.5
11-Sep	24	56.5	52.5	51.5
12-Sep	1	57.0	54.0	52.5

APPENDIX D

Statistical Ambient Sound Levels
Position 1: Engineer's House
Point Shirley, Winthrop, MA
(continued)

DATE (1986)	TIME	dBA L10	L50	L90
12-Sep	2	53.0	51.5	50.5
12-Sep	3	52.0	51.0	50.0
12-Sep	4	53.0	51.5	50.5
12-Sep	5	52.0	50.0	47.5
12-Sep	6	67.0	51.5	47.5
12-Sep	7	77.0	62.0	54.5
12-Sep	8	74.0	60.0	50.0
12-Sep	9	72.0	60.0	54.0
12-Sep	10	67.5	56.0	50.0
12-Sep	11	74.0	58.5	51.0
12-Sep	12	76.0	59.0	50.0
12-Sep	13	67.0	55.0	50.0
12-Sep	14	70.5	56.5	50.5
12-Sep	15	70.5	57.5	53.0
12-Sep	16	63.5	57.0	53.0
12-Sep	17	62.5	56.5	52.5
12-Sep	18	63.5	57.0	52.5
12-Sep	19	63.0	56.0	51.0
12-Sep	20	65.0	57.0	50.5
12-Sep	21	64.0	55.0	53.0
12-Sep	22	59.5	55.5	54.0
12-Sep	23	57.0	54.0	51.5
12-Sep	24	51.0	49.5	49.0
13-Sep	1	51.0	48.5	47.0
13-Sep	2	49.5	45.5	42.0
13-Sep	3	43.0	41.0	39.0
13-Sep	4	47.0	41.5	39.5
13-Sep	5	48.5	46.5	45.5
13-Sep	6	64.0	48.0	45.5
13-Sep	7	70.5	56.5	49.0
13-Sep	8	71.5	57.0	47.0

APPENDIX D

Statistical Ambient Sound Levels
Position 1: Engineer's House
Point Shirley, Winthrop, MA
(continued)

DATE (1986)	TIME	dBA L10	L50	L90
13-Sep	9	73.0	57.0	51.0
13-Sep	10	67.5	54.5	49.5
13-Sep	11	73.5	59.0	51.0
14-Sep	12	71.0	59.5	52.5
14-Sep	13	62.5	55.5	51.5
14-Sep	14	64.5	58.0	51.5
14-Sep	15	60.5	53.5	48.5
14-Sep	16	61.5	54.0	47.0
14-Sep	17	62.5	55.0	46.5
14-Sep	18	61.0	53.5	46.0
14-Sep	19	62.5	54.5	47.5
14-Sep	20	62.5	52.5	45.0
14-Sep	21	60.5	51.5	42.0
14-Sep	22	60.5	50.0	42.5
14-Sep	23	56.5	45.5	40.0
14-Sep	24	52.5	41.0	39.5
15-Sep	1	47.0	44.0	42.0
15-Sep	2	43.0	41.5	40.0
15-Sep	3	56.5	46.5	42.0
15-Sep	4	54.5	48.5	43.5
15-Sep	5	88.5	52.5	45.0
15-Sep	6	76.0	57.5	46.0
15-Sep	7	82.0	62.0	54.0
15-Sep	8	82.0	63.5	52.5
15-Sep	9	71.0	60.0	51.5
15-Sep	10	69.5	58.5	51.5
15-Sep	11	70.0	59.5	53.0
15-Sep	12	70.0	60.5	53.0
15-Sep	13	71.5	59.0	52.0
15-Sep	14	68.0	59.0	52.5
15-Sep	15	72.5	62.0	54.5

APPENDIX D

Statistical Ambient Sound Levels
Position 1: Engineer's House
Point Shirley, Winthrop, MA
(continued)

DATE (1986)	TIME	dBA L10	L50	L90
15-Sep	16	71.5	61.5	55.0
15-Sep	17	73.0	62.5	56.5
15-Sep	18	72.0	61.0	55.0
15-Sep	19	72.5	60.0	54.5
15-Sep	20	67.0	57.0	50.5
15-Sep	21	66.0	56.0	49.5
15-Sep	22	55.0	54.5	49.5
15-Sep	23	59.0	52.0	49.0
15-Sep	24	56.5	50.0	47.5
16-Sep	1	53.5	49.0	46.5
16-Sep	2	55.0	49.0	46.5
16-Sep	3	49.5	44.5	43.0
16-Sep	4	48.0	45.0	43.5
16-Sep	5	47.5	45.0	44.0
16-Sep	6	65.0	51.0	46.5
16-Sep	7	69.5	57.5	50.5
16-Sep	8	68.5	57.5	50.0
16-Sep	9	68.0	56.5	49.0
16-Sep	10	62.0	54.5	44.0
16-Sep	11	65.0	55.0	45.5
16-Sep	12	65.5	53.5	45.0
16-Sep	13	61.5	49.0	43.5
16-Sep	14	69.5	48.5	44.5
16-Sep	15	72.0	50.0	44.5
16-Sep	16	74.0	53.0	47.5
16-Sep	17	77.0	55.5	47.0
16-Sep	18	78.0	56.0	50.0
16-Sep	19	76.5	53.5	48.0
16-Sep	20	56.5	48.0	44.0
16-Sep	21	60.5	50.0	43.0
16-Sep	22	59.0	48.0	42.0

APPENDIX D

Statistical Ambient Sound Levels
Position 1: Engineer's House
Point Shirley, Winthrop, MA
(continued)

DATE (1986)	TIME	dBA L10	L50	L90
16-Sep	23	57.0	43.5	41.0
16-Sep	24	46.5	41.5	40.0
17-Sep	1	48.5	40.0	38.5
17-Sep	2	48.0	44.0	39.0
17-Sep	3	43.0	39.5	38.5
17-Sep	4	41.5	39.5	38.5
17-Sep	5	51.5	44.5	39.5
17-Sep	6	62.0	50.0	44.0
17-Sep	7	64.5	59.0	53.5
17-Sep	8	64.5	59.0	54.0
17-Sep	9	62.5	56.0	50.5
17-Sep	10	60.0	54.0	48.5
17-Sep	11	61.0	54.0	47.5
17-Sep	12	61.0	54.0	49.0
17-Sep	13	58.5	52.0	47.0
17-Sep	14	58.5	52.0	48.5
17-Sep	15	59.5	53.0	50.0
17-Sep	16	59.0	53.0	50.0
17-Sep	17	61.5	54.5	50.5
17-Sep	18	62.0	55.0	49.5
17-Sep	19	62.0	55.5	51.0
17-Sep	20	61.0	55.5	50.0
17-Sep	21	62.5	53.5	48.5
17-Sep	22	62.0	52.0	45.0
17-Sep	23	56.5	48.0	44.5
17-Sep	24	56.5	47.5	42.5
18-Sep	1	51.0	47.5	44.0
18-Sep	2	49.5	47.5	46.5
18-Sep	3	48.5	47.5	46.0
18-Sep	4	52.0	49.0	43.5
18-Sep	5	50.5	46.0	42.5

APPENDIX D

Statistical Ambient Sound Levels
Position 1: Engineer's House
Point Shirley, Winthrop, MA
(continued)

DATE (1986)	TIME	-----------dBA----------- L10	L50	L90
18-Sep	6	59.5	49.5	45.0
18-Sep	7	63.5	57.0	50.5
18-Sep	8	64.0	57.0	51.5
18-Sep	9	61.5	54.5	48.0
18-Sep	10	60.0	50.0	45.0
18-Sep	11	62.0	54.0	46.0

Appendix E

APPENDIX E

ARCHAEOLOGICAL DOCUMENTARY RESEARCH

UNDERTAKEN BY

PUBLIC ARCHAEOLOGY LABORATORY, INC.

APPENDIX E

ARCHAEOLOGICAL DOCUMENTARY RESEARCH UNDERTAKEN BY PUBLIC ARCHAEOLOGY LABORATORY, INC.

Institutions like those on Deer Island have long and complex histories, particularly when the operation of such facilities has shifted between various city departments or from city to state or federal agencies or jurisdiction. Of primary importance to this research were documents of the different City of Boston boards of directors, committees and departments which have controlled the numerous Deer Island institutions during the past 140 years. Included among these were Annual Reports of the Public Institutions and Penal Institutions departments, the Houses of Industry, Reformation and Correction, the Overseers of the Poor, the Harbor Master and the City Auditor. The documents were located in the Massachusetts State Library and provided much valuable information.

Unfortunately, although daily and weekly reports of the immediate supervisors of the institutions (including specific information concerning inmates admitted and discharged, physical examinations, visitors to the institutions, and log books of the Houses of Industry and Correction) were located, they were not readily accessible. Many of these documents, some 318 volumes, discovered in the old prison building following a fire, were only sketchily inventoried by Dr. Dennis P. Ryan and Mr. Earl Hamilton in 1985 prior to their transfer to the library at Boston College for preservation and cataloging (Penal Department Communication 1985). Cataloging and indexing of the collection has not yet been completed. Dr. Ryan, who has looked through much of the material, could not remember seeing listings of deaths or burial locations nor information on cemeteries (Dr. Ryan, personal communication, 1987). Mr. Hamilton provided information concerning a "Death Book" maintained at Deer Island. However, as yet, permission has not been received to visit the island and consult this potentially valuable resource.

In addition to the consultation of city documents, the records of the U.S. Army Corps of Engineers at the National Archives and Records Administration Center in Waltham, Massachusetts were examined. The numerous memos, letters and documents relating to the purchase of the military reservation on the southern portion of the island for harbor defense and the subsequent transaction between city and military officials, provided detailed information on the old City of Boston Cemetery located on the military reservation.

Letters were mailed and/or phone calls made to individuals and departments concerned with or knowledgeable about Deer Island. Among those contacted were Captain Swanson of the Metropolitan District Commission, Earl Hamilton of the Penal Institutions Department, Superintendent Broderick and Mrs. Bondar at the Suffolk County House of Correction on Deer Island, the Cemetery Division of the Parks and Recreation Department. Death Section of the City Clerks Department, and Dr. Dennis P. Ryan, a historian of the Boston Irish and consultant to Burns Library at Boston College.

In addition to these primary sources of data, secondary sources on Boston history, Irish immigration, and other related issues were consulted. These sources provided much of the historical background necessary to understand the public institutions established on Deer Island and the inmates who occupied them.

Working within these constraints, this research has focused on the issue of death and burial at the Deer Island institutions to trace the origins and history of the cemeteries on the island. Historical background on the development of the various public institutions is provided to complete and complement this research goal.

Public Institutions on Deer Island

During the 140 years since the City of Boston took possession of Deer Island in 1847 for "sanitary purposes", the island has served as a repository for individuals and a location for institutions considered undesirable within the core urban area.

More than 25,000 alien passengers, many of them Irish immigrants, arrived in Boston during 1847 (Abbott 1926:589). The numbers of ill and dying arriving in Boston were so great that, during the summer of 1847, a receiving room was constructed at Long Wharf in which these invalids could wait for transportation to hospitals. That year, a quarantine hospital was established on Deer Island for the express purpose of receiving alien passengers "as a precautionary measure to ward off a pestilence that would have been ruinous to the public health and business of the city" (Massachusetts Senate Doc. 46, 1848:10).

Large numbers of these immigrants who were sent to Deer Island never recovered. Of 4,816 persons admitted between the opening of the hospital in June, 1847 and January 1, 1850, 4,069 were sick when admitted and 759 died on the island (Abbott 1926).

In 1849, the City of Boston confirmed its earlier decision to use Deer Island as "the place of quarantine for the Port of Boston" (City Doc. 27, 1849:5). All ships entering Boston Harbor containing passengers or cargo considered to be "foul and infected with any malignant or contagious disease" were required to anchor at Deer Island until such time as the Port Physician gave permission to leave following removal of passengers and cleaning and purification of the vessel (City Doc. 27, 1849:6).

Prior to 1849, the city maintained only one institution on Deer Island, a quarantine station and hospital for immigrants and paupers unable to care for themselves, located on the southern half of the island. Beginning in that year, most of the Deer Island facilities were "occupied as an appendage to the South Boston establishment" of the House of Industry (City Doc. 25, 1849:4). As of March 31, 1849, the Deer Island Department of the House of Industry had 396 inmates. The hospital continued at Deer Island until 1866 when it was replaced by a new hospital on Gallop's Island (Mikal 1973:50).

A brick building was completed in 1852 to house the Deer Island Almshouse and House of Industry located on the northern half of the island. While these two institutions were considered

separately in much of the official documentation, a major problem on the island was the close association of the two categories of inmates. The Almshouse was established to serve the virtuous or deserving poor, and these individuals were permitted to live at Deer Island when they were unable to support and care for themselves. Facilities provided for the Almshouse population included a nursery, schools, hospital (shared with other institutions), housing, and workshops.

The inmates of the House of Industry were sentenced by the courts to serve time at Deer Island for misdemeanors and crimes committed in the City, including large numbers of individuals sentenced for drunkenness and idleness. This second category of inmates, the sentenced or vicious poor, were seen as a bad influence on the Almshouse population and on the children within the institution (City Doc. 27, 1857:7; City Doc. 25, 1860:5). However, it was not until construction of additional facilities to relieve overcrowding during the latter half of the nineteenth century that a more or less total separation of the two groups of inmates was accomplished. Meanwhile, the population of those institutionalized grew quickly from the 331 recorded in 1856 to 1,746 inmates in the combined institutions in 1886.

In addition, as early as 1854, Deer Island was being considered for the location of a new House of Correction. In that year the Committee on Public Buildings authorized a portion of the brick building, then housing the Almshouse and House of Industry, to be remodeled by the addition of cells, for use as a prison facility (City Doc. 24, 1856:3). As a result, inmates of the building were redistributed among the other structures on the island, most of them "inadequate and incommodious" (city Doc. 27, 1857:6). In November of 1858, the building was completed and the city poor in the House of Industry were moved into it from the wooden buildings. At this time a portion of the building was also allocated for the use of the House of Reformation. No prisoners from the House of Correction were yet sent to the island.

During the summer of 1858, the House for the Employment and Reformation of Juvenile Offenders-Boys was transferred from South Boston to new quarters at Deer Island. Boys sentenced for misdemeanors such as truancy, larceny and idleness were sent here for discipline (Snow 1971:156). Shortly thereafter, in the fall, a school for girls was established in the House of Industry and became known as the House of Reformation-Girls. Between 1866 and 1873 neglected children were transferred to the Almhouse facilities (Bradlee 1976:9-12). Also present on the island at this time, to serve the needs of children, were the Pauper Boys and Pauper Girls Schools within the Almshouse, serving the deserving poor. Until 1869/1870, the children were housed with the men and women of the institutions. After that date, with construction of new facilities, boys and girls were not only separated from each other, but also from the adults.

The year 1877 saw a number of changes in the population and institutions at Deer Island. Adult female paupers were removed to Austin Farm. The pauper and neglected boys were removed to the Marcella Street Home in Roxbury. This helped to relieve the crowded conditions at the main building. The only paupers remaining at Deer Island Almshouse following this reorganization were the young children in the nursery, pauper girls. and a few adult females too ill to be transferred with the rest (City Doc. 49, 1877:18).

In 1882, a House of Correction was established at Deer Island with the transfer of some inmates from the House of Correction in South Boston. Young men were sent to Concord Reformatory, the rest went to Deer Island. The House of Correction was not considered a reformatory, but "merely a place of punishment and detention" (City Doc. 9, 1887:34). Men were employed in many occupations on the island, i.e., farming, stone cutting, and manufacturing a number of items.

In Chapter 536, Section 9, of the Acts of 1896, the institution formerly known as the House of Industry on Deer Island "was established as a Suffolk County Institution, and designated as the House of Correction at Deer Island" (City Doc. 14, 1897:1). A new cell building was completed about this time, providing 500 additional cells. It was not until 1902 that the last of the inmates housed in the House of Correction in South Boston were moved to Deer Island and the consolidation completed. After this date the House of Correction was the only City of Boston institution located on Deer Island. All other inmates in the Almshouse and schools had been moved to other locations.

In 1906, following negotiations between the City of Boston and the U.S. Government, the City deeded nearly 100 acres in the southern portion of Deer Island to the federal government for the construction of a military reservation and harbor defenses (Suffolk Co. Registry Book 3177:577). Included in the stipulations of this transfer was the agreement that the City would build a boundary wall between City and military reservation property, remove the old piggery and other City property, discontinue cultivation and removal of sand, gravel and sod, and discontinue burials in old Resthaven Cemetery on the new military reservation property (U.S. Army Corps of Engineers).

A sewage treatment plant was constructed on the island in 1889 with a major outlet into the harbor built at the south end of the island. In the 1950's some 39 acres of land adjacent to the prison facilities on the south end were taken by the Metropolitan District Commission for an "antipollution and sewer project" (City Doc. 17, 1957:3). The resulting sewage treatment plant was completed in 1968.

Documents of the City of Boston indicate that through time Deer Island has become the final resting place for large numbers of individuals. During the forced occupation of Deer Island by "friendly" or "Christian" Indians during King Phillip's War in 1675, many of the Native Americans died. As they were not allowed to leave the island, burial of the dead presumably took place on Deer Island. Sweetser (1883:195) stated that of "500 martyrs to English distrust very many died, and were sadly buried by the moaning and misty sea." The locations of such burials was not recorded and is unknown. No evidence of Native American burials has been recovered from archaeological surveys on the island.

Prior and subsequent to King Phillip's War, Deer Island was leased by the City of Boston to a number of individuals or families (Snow 1971:199-203). The records do not provide any details regarding deaths or interments on the island by any of these tenants. None of the early maps of Deer Island indicate locations of burials or cemeteries.

Since 1847, when the City of Boston took possession of Deer Island "for sanitary purposes", the

island has been the home of various public institutions for the care of both adult and juvenile ill, poor homeless, and sentenced offenders as described above. As such, it has also been the site of many deaths and subsequent burials of the unclaimed dead. It is on the burials and cemeteries associated with the institutions that this research focused in the effort to determine the dates, identities, methods of burial, and institutional affiliations of the interments in the new cemetery.

The initial years of the Quarantine Hospital and Almshouse at Deer Island was the period of the major influx of Irish immigrants fleeing the potato famine and disease in Ireland. Between 1847, when the institutions were established, and the end of 1849, some 4,816 persons had been admitted. Of this total number, 4,069 were ill upon their arrival at Deer Island and 759 died on the island (Abbott 1926:598). Some 721 individuals were buried on Deer Island during the years 1847-1849. These interments appear to have been made in the old Resthaven Cemetery, located on the southern portion of the island, later owned by the U.S. government (U.S. Army Corps of Engineers 1908). The discrepancy between the number of deaths and the number of burials most likely indicates that some bodies were claimed by family or friends for burial elsewhere, while only the unclaimed or indigent were buried at city expense on the island.

From the initially large numbers in 1847 to 1854, deaths and burials on the island declined sharply between 1854 and 1855 along with the drop in immigration to Boston. The number of burials remained low through the Civil War years, increasing in the mid 1870's. The reason for this increase remains unclear, although general economic conditions were bad, possibly leading to greater numbers of poor being sent to the Almshouse and House of Industry.

Deaths and burials on the island decreased with slight fluctuations through the end of the nineteenth century. This reduction in the number of deaths and burials on Deer Island can probably be linked to improved sanitray conditions and health care as well as to the change in the composition of the institutionalized population. Prior to 1896, persons residing at Deer Island institutions were a varied group of men, women and children, many of whom had been living in exteme poverty conditions and were in poor physical condition, if not ill, upon their arrival. After 1896, the population at Deer Island was primarily composed of inmates in the House of Correction who had been sentenced for crimes committed, but had not necessarily been poor or ill before their arrival. In general, this latter population was healthier than those who had preceded them on Deer Island.

The records available, primarily Annual Reports of the various city committees and departments in charge of the institutions on Deer Island, provide little information about the manner in which deaths, funerals and burial were handled on the island. Even the reports of the chaplains at the institutions fail to mention deaths or burials. Only one chaplain's report was noted which mentioned that "funeral and baptismal rites have been attended to when called upon" (City Doc. 14, 1897:51).

Burial on Deer Island was referred to indirectly in several annual reports mentioning construction activities related to burials and cemeteries. In the "Annual Report of the Directors of the House of Industry and Reformation. for the Year 1856-1857" construction of new tombs was reported:

> The Tombs, originally located on the north easterly face of the Island, being found unsuited to their purposes, from their exposure to flooding by the action of the sea in severe storms, have been discontinued; and the material used in the construction of new ones in a more secure and suitable position. (City Doc. 40, 1857:4)

Construction of the new tombs was in an undisclosed location. In addition, during the same year, labor was expended in "digging graves for reception and depositing the bodies removed from City of Boston" (City Doc. 40, 1857:21). There is no explanation provided about how many graves were dug or where and why these bodies were removed from Boston for burial on the island.

A morgue was built on Deer Island in 1886 for the use of the various institutions as needed. The annual report for that year refers to the morgue as:

> A neat and appropriate house ... for temporary deposit of the bodies of those who may die, with room for showing the bodies to friends, and where funeral services can be performed when they are not removed for burial in other grounds (City Doc. 9, 1887:38)

Where bodies were buried if unclaimed and not removed from the island was not mentioned in the report. The first mention found in city documents and annual reports of the presence of a cemetery on Deer Island came in the 1909 "Annual Report of the Penal Institutions Department." This report, which post dates the sale of the southern portion of Deer Island from the City of Boston to the U.S. Government, makes reference to city compliance with one of the stipulations in the deed of transfer.

> Owing to the taking of the land from the institution by the United States Government the creation of a new cemetery and receiving tomb were made necessary, and these have been completed. All the bodies in the old cemetery have been carefully transferred. (City Doc. 29, 1909:8).

The old cemetery referred to is "Resthaven (City of Boston) Cemetery at Deer Island" located on the military reservation property, southeast of the gate through the concrete boundary wall separating the City and Federal property on the southern end of the island.

A document and letter on file in the U.S. Army Corps of Engineers records provides information about Resthaven located from City records in 1908 (U.S. Corps of Engineers, 1908).

> [Captain Fredendall] secured from the City of Boston the records showing the number of bodies interred therein and dates thereof, which show that this cemetery has been used for the burial of all immigrants dying at the quarantine station or brought in from ships from 1847 to 1882, since which date it has been used for burial of criminals dying at the penal institutions, City of Boston, not claimed by relatives or friends.

Fredendall's letter further indicates that in 1908 Resthaven Cemetery contained 4,160 bodies "interred in lots of eight or ten in trenches."

If "all the bodies" in the old Resthaven Cemetery were removed to the new cemetery, presumably to the cemetery on the northeast hill behind the prison and between the piggery and the boundary wall, this new cemetery would have contained 4,160 bodies as of its creation in 1908. Subsequent deaths and burials of institution inmates would have added somewhat to that number.

Unfortunately, conflicting evidence exists in the U.S. Army Corps. of Engineers records suggesting that only the eighteen bodies deposited in old Resthaven Cemetery in 1908, after the final sale of the property, were transferred to the new northeast cemetery. This is substantiated by a letter from the Master of the Suffolk County House of Correction on Deer Island dated December 30, 1908. Master Cronin reported that the 18 bodies in question, those placed in Resthaven subsequent to the sale, had been removed (U.S. Army Corps of Engineers 1908). His letter does not indicate that "all the bodies" were transferred as stated in the annual report. This conflicting evidence raises some questions as to the exact number of bodies in the newer northeast cemetery.

A further question relating to this new northeast cemetery concerns how long it was in active use following its creation in 1908. No additional mention of its presence or use was noted in subsequent city documents. A 1923 map of the city property on Deer Island, which accompanied a report considering relocating the State Prison to the island, showed all existing and planned structures, but did not indicate the cemetery plot nor the associated receiving tomb. It seems unlikely, though possible, that if the plot was in active use, its existence would be omitted from this planning document. This leaves some doubt as to whether bodies were being buried in the cemetery in 1923. However, the cemetery is indicated in 1946 U.S.G.S. topographic maps and on the current maps.

An interview with Mr. Earl Hamilton of the Penal Institutions Department, and a former Superintendent of the Suffolk County House of Corrections at Deer Island, provided additional evidence concerning the new northeast cemetery (personal interview, 1987). According to Mr. Hamilton, the new northeast cemetery is also called Resthaven, or new Resthaven. He was unsure as to how long it remained in use, but suggested that it was likely that bodies were buried there until the road was built connecting Deer Island with Winthrop after the U.S. Army Corps of Engineers filled Shirley Gut in 1933/1934.

Current practice on the island with regards to deceased prisoners is to call a Boston mortuary to pick up the body. Following an autopsy the death is logged in the prison death book and the body is either turned over to relatives or, if unclaimed, is buried in a City pauper cemetery such as Mt. Hope Cemetery (Hamilton, personal interview, 1987).

In 1970, when Mr. Hamilton began working at Deer Island, the new northeast cemetery or new Resthaven was marked by some 30 to 40 white wooden crosses in poor repair. A photograph in Mr. Hamilton's posession, dated to 1929, shows the cemetery in the upper center as a large area stretching between the piggery to the boundary wall and tightly filled with white wooden crosses (Figure 6.3.1-1, page 6-68). Judging by this photo it appears likely that indeed all 4,160 bodies from old Resthaven had been transferred and reinterred in the new Resthaven cemetery above the Hill Prison Building. In addition. Mr. Hamilton knew of no reason to believe that these bodies had been removed from the island since the picture was taken.

Sometime prior to the 1970's, the practice of sending details of prisoners to paint the crosses and maintain the cemetery had ceased. The condition of the cemetery had been allowed to deteriorate until it was barely acknowledgeable as a cemetery in 1985.

The primary goal in this research has been to discover as much information as possible relating to the new cemetery noted in the 1985 archaeological reconnaissance survey and located on the northeast slope behind the Hill Prison building. Three hypotheses concerning this cemetery were developed and tested using the data collected.

Hypothesis I concerned the possibility that the new northeast cemetery contained only bodies of inmates of the House of Correction who died since the closing of old Resthaven Cemetery after the sale of the southern portion of Deer Island to the U.S. military. In this case, few bodies would be expected; only those bodies unclaimed between 1907-1908 and the present.

Hypothesis II was similar to the first hypothesis, but indicated that the eighteen bodies buried in the old cemetery on the island during or since the sale to the U.S. Government may have been reinterred in the new cemetery along with unclaimed bodies buried in the years since the property transfer.

Hypothesis III suggested that, upon the sale of the southern portion of Deer Island, all 4160 city interments in old Resthaven were removed to the new cemetery closer to the prison facilities. This hypothesis also took into account the probability that subsequent bodies may have been added.

During the course of the in-depth documentary research, contradictory evidence was uncovered concerning the origins and development of the new northeast cemetery. No data was recovered which supported Hypothesis I. The only mentions made of the new cemetery also referred to reinterments. Evidence collected from the U.S. Army Corps of Engineers documents tended to support Hypothesis II, suggesting that 18 bodies had been transferred from old Resthaven Cemetery and reinterred in the new northeast cemetery. City documents, though containing little information pertaining to burials at all, indicated that "all the bodies in the old cemetery" were reinterred in the new plot (City Doc. 29, 1909:8).

It now appears most likely that Hypothesis III is correct, that the cemetery in question is "New Resthaven Cemetery" created in 1908 with the reinterment of some 4,160 bodies from old Resthaven Cemetery in the military reservation on the southern portion of Deer Island. The cemetery, at its present location, is 79 years old, or greater than 50 years of age, which requires additional archaeological investigations in accordance with NHPA. In addition, 2,559 of the bodies reinterred in new Resthaven are 100 years of age or older. many of them having been quarantine hospital victims and Irish immigrants. Additional unclaimed bodies were probably buried in the plot at least through the early 1930's when Shirley Gut was finally filled and Deer Island was connected by road to Winthrop.

What this research has revealed is that the new northeast cemetery plot. or new Resthaven. is much larger than expected from the cursory field inspection of the site. Judging by the 1929 photo shown in Figure 6.3.1-2, the cemetery extended from the northeast wall of the old piggery

to the cement boundary and wall from the sea wall at the top of the slope to the mausoleum at the foot of the slope. The many wood scraps originally thought to be picket fence remains and, therefore, assumed as markers of the plots' boundary, were more likely remnants of the wooden crosses which were once maintained to mark the graves in the tightly packed cemetery. As no evidence has been found suggesting the removal of these burials to another location, it is expected that some 4,160 to 4,500 bodies remain interred in the new cemetery. The only evidence for the plan of burials within the new cemetery is the 1929 photo. It suggests that either individual graves were located very close together or that individual crosses marked bodies buried in trenches. The latter possibility seems most probable for the reinterments due to the age and likely condition of the earlier burials when transferred from old Resthaven Cemetery, where evidence indicates the bodies were buried eight to ten per trench.

Additional archaeological testing was undertaken in May 1987. The results will be included in the final report. Two methods of remote sensing techniques, soil resistivity and electron magnetometry, have been used to attempt to discern any patterns of disturbance that may be present in the area of the historic period cemetery and could possibly signify burials. Experience with soil resistivity testing at several historic period cemeteries ranging in age from the late seventeenth to nineteenth centuries has indicated that more recent burials have greater resistivity. A soil resistivity survey of the Deer Island cemetery to identify the probable location of burials prior to any actual subsurface testing. Electron magnetometry works in a similar manner and has been used as a second verification method. The results of the soil resistivity and electron magnetometry surveys have been used to develop a map or plan of the location of soil anomalies. This map was subsequently used in consultation with the Massachusetts Historical Commission, to plan an effective subsurface testing or burial verification program for the cemetery.

The primary objectives or tasks for the recommended fieldwork have included: (1) determination of the horizontal extent of the cemetery through systematic subsurface testing; and (2) collection of sufficient data to reconstruct the internal configuration or plan of the cemetery and general mode of burial (individual graves, multiple burials in trench, etc.) used at this site.

Actual subsurface testing within the known cemetery is being performed in July, 1987, to verify the existence of burials. This fieldwork involves the use of both machine assisted and hand excavation techniques. A small backhoe or similar machine will be used to excavate a series of narrow trenches through the cemetery to expose the upper surface of filled grave shafts. Machine excavated trenches could be oriented in several ways within the cemetery area. Subsurface anomalies located by soil resistivity testing that represent potential unmarked burials could be tested with judgementally oriented trenches placed on the locations of these anomalies. Other deliberately placed trenches will be necesary to identify the horizontal limits of the cemetery if it is found to actually contain unmarked burials. Given the moderately sloping surface of the cemetery, the machine excavated trenches will probably have to be oriented perpendicular to the natural slope, since it would be unlikely that a backhoe or similar equipment could operate across this slope. These trenches will be excavated with machinery (small backhoe or front-end loader) only to a depth suficient to identify a filled grave/burial shaft. Once a definitive grave shaft or fill has been identified, hand excavation

will be used to complete the investigation. Excavation with hand tools would proceed only until the presence of human skeletal remains can be verified within an identified grave or burial. Once human skeletal remains have been positively identified they will be left in situ and the State Archaeologist will be notified.

Representative soil profiles will be recorded from all machine excavated trenches and scaled drawings made of profiles exposed during the excavation of specific burials. The locations of trenches excavated during the archaeological investigation and any burials identified during the survey will also be mapped. All aspects of the archaeological investigation will be recorded in documentary photographs (color, black/white). This would include photographing any burials located and positively identified during fieldwork. The final report summarizing the results of the archaeological testing will be included in the Treatment Plant EIR/EID, Volume III.

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Appendix F

APPENDIX F

1986 LEGISLATIVE ACT IMPROVING
JAILS, HOUSES OF CORRECTION, AND
CORRECTIONAL INSTITUTION IN THE COMMONWEALTH

H 6391

Chapter 658.

THE COMMONWEALTH OF MASSACHUSETTS

In the Year One Thousand Nine Hundred and Eighty-six

AN ACT IMPROVING JAILS, HOUSES OF CORRECTION, AND CORRECTIONAL INSTITUTIONS IN THE COMMONWEALTH.

Whereas, The deferred operation of this act would tend to defeat its purpose, which is to provide for the immediate takeover by the commonwealth from the counties of the maintenance and operation of jails and houses of correction in the several counties of the commonwealth, and to provide for immediate relief to the counties and cities and towns by relieving them of the said costs, and to integrate and coordinate said facilities into a statewide modern correctional system, and to relieve the serious overcrowding problems in the correctional institutions of the commonwealth, therefore it is hereby declared to be an emergency law, necessary for the immediate preservation of the public convenience.

Be it enacted by the Senate and House of Representatives in General Court assembled, and by the authority of the same, as follows:

SECTION 1. The division of capital planning and operations is hereby authorized to expend fifty-eight million dollars for studies, the preparation of plans, the acquisition of land by purchase, gift, land exchange, eminent domain, lease or otherwise, and the construction, including furnishings and equipment, of a new facility in Suffolk county to replace the Suffolk county house of correction presently at Deer Island; provided, however, that such new facility shall have a capacity not to exceed five hundred seventy beds; provided, further, that no funds appropriated herein shall be expended for the purposes of replacing said Deer Island house of correction until such time as the city of Boston shall convey for consideration of one dollar to the division of capital planning and operations on behalf of the commonwealth, in deed approved as to form by the attorney general, the title to the land and buildings at the site of the Deer Island house of correction; provided, further, that the city of Boston is hereby authorized to convey such title to such land as provided herein; provided, further, that except for any portion of said land which may be needed for the construction of new wastewater treatment fa-

cilities at Deer Island, said land at said site shall be preserved as open space to mitigate the impact of the construction of said wastewater facilities; provided further, that said division is hereby authorized to acquire such land only at the site described in section two; provided, further, that the city of Boston shall convey to the commonwealth for consideration of one dollar title to property owned by said city within said site in accordance with said section two; provided further, that control and possession of said Deer Island house of correction shall remain with the city of Boston until such time as said replacement facility is constructed and until all occupants of the present facility have been removed; provided further, that the employment status of the current employees of the Deer Island house of correction shall be in no way impaired or altered by the provisions of this act; provided, further, that said replacement facility shall include housing for female prisoners sufficient to meet the needs of the region; and provided, further, that said facility shall include housing units at all security levels.

SECTION 2. The replacement facility for the Suffolk county house of correction presently at Deer Island shall be constructed within the boundaries of the following site, the site being the parcel of land circumscribed as follows: beginning at the westerly boundary of the city of Boston property on Southampton Street and proceeding clockwise along Southampton Street to the intersection of Southampton Street and Bradston Street, then proceeding along Bradston Street to the intersection of Bradston Street and South Bay Avenue, then proceeding along South Bay Avenue to the intersection of South Bay Avenue and Atkinson Street, then proceeding along Atkinson Street to the most northerly boundary of the most northerly city of Boston traffic and parking building, then westerly and southerly along the city of Boston property line to the point of beginning.

The city of Boston is hereby authorized to transfer to the commonwealth of Massachusetts, through its division of capital planning and operations, title to the property owned by said city located within said parcel at the corner of South Bay Avenue and Atkinson Street, comprised of approximately forty-eight thousand three hundred and fifteen square feet, more or less, the precise configuration of which shall be determined by a survey prior to transfer, to be used by the commonwealth for the purposes described in this act. The deputy commissioner of the division of capital planning and operations shall determine the location of the replacement facility within said parcel and shall on-

ly acquire the land he determines necessary and appropriate for the construction and operation of the facility.

SECTION 3. The division of capital planning and operations is hereby authorized to expend an additional fourteen million, seven hundred fifty thousand dollars for studies, preparation of plans, the acquisition of land, the construction, including furnishings and equipment, of a new facility in Suffolk county to replace the Charles street jail, such amount to be in addition to and subject to the same conditions as the amount authorized pursuant to section five of chapter seven hundred ninety-nine of the acts of nineteen hundred and eighty-five.

Said division, in addition to the provisions of section two of chapter three hundred ninety-six of the acts of nineteen hundred and eighty-six, is hereby authorized to acquire by eminent domain any easements or interests of record currently owned by the Boston and Maine railroad in the Nashua street area of the city of Boston, and other land, right-of-ways or easements necessary to relocate or replace the utility lines displaced by construction of the replacement facility for the Charles street jail.

SECTION 4. The secretary of the executive office of human services is hereby authorized to expend a maximum of no more than fifty-one million dollars for the purpose of a grant program to assist Hampden county in undertaking feasibility studies, acquiring land, providing technical assistance or expertise, making preliminary plans, and designing, or constructing a house of correction not to exceed five hundred beds; provided, however, that the design and planning for said house of correction shall include provisions to house female inmates sufficient to meet the needs of the region; and provided, further, that said facility shall include housing units at all security levels.

SECTION 5. The division of capital planning and operations is hereby authorized to expend seventy-two million dollars for studies, the preparation of plans, the acquisition of land by purchase, gift, land exchange, eminent domain, lease or otherwise, and for the construction, including furnishings and equipment, of two medium security correctional facilities each of a capacity not to exceed five hundred beds; provided, however, that no funds shall be expended for the acquisition of such land until the deputy commissioner of said division completes a study, as defined in section thirty-nine A of chapter seven of the General Laws, evaluating the feasibility of locating a medium security correctional facility on such land.

SECTION 6. In addition to the amount authorized by section six of chapter seven hundred ninety-nine of the acts of nineteen hundred eighty-five, the division of capital planning and operations is hereby authorized to expend ten million, five hundred fifty thousand dollars for studies, the preparation of plans, and the renovation, upgrading and expansion of existing state correctional facilities, including the costs of furnishings and equipment; provided, however, that no more than four million dollars of this additional amount shall be expended on maximum security facilities.

SECTION 7. Said commissioner of the department of corrections is hereby authorized to expend for a study and the preparation of plans, if necessary, and for the demolition and alterations of certain buildings and the construction of certain buildings at Massachusetts Correctional Institution, Framingham, including renovations to the water distribution system and the cost of furnishings and equipment, an amount not to exceed one million, three hundred thousand dollars in addition to the amounts appropriated in item 4315-8841 of chapter seven hundred and twenty-three of the acts of nineteen hundred and eighty-three.

Said commissioner is hereby further authorized to expend for the design and construction, including furnishings and equipment, for a program building for a new turbine generator and for a feasibility study to expand the wastewater treatment plant at Massachusetts Correctional Institution, Concord, an amount not to exceed five million four hundred thousand dollars.

SECTION 8. The amounts appropriated by this act shall be in addition to previous appropriations made for the development of correctional facilities, including amounts made available pursuant to chapter three hundred and forty-seven of the acts of nineteen hundred and eighty-two, chapter seven hundred and twenty-three of the acts of nineteen hundred and eighty-three and chapter seven hundred and ninety-nine of the acts of nineteen hundred and eighty-five.

SECTION 9. The deputy commissioner of capital planning and operations shall establish a special unit to be assigned to expedite the planning, design, and construction of the projects authorized by sections one and three through seven, inclusive. A similar special unit shall also be established by the commissioner of correction. Said deputy commissioner or the commissioner of correction may, in accordance with a schedule annually approved by the commissioner of administration, temporarily hire additional employees or consultants and assign any employee of the division of capital planning and opera-

tions or the department of corrections, respectively to said special unit; provided, however, that the salaries and administrative expenses for both of the special units shall be paid from funds authorized by this act as a part of the cost of the development and construction of said projects; and provided, further, that thirty days prior to the hiring or transfer of said additional employees, said deputy commissioner or the commissioner of corrections shall notify the house and senate committees on ways and means.

In addition, within ninety days of the effective date of this section, said deputy commissioner shall develop and publish a detailed schedule designed to meet an October, nineteen hundred and eighty-nine deadline for the decommissioning of the Suffolk county house of correction at Deer Island.

SECTION 10. For the purpose of alleviating overcrowded conditions in jails, houses of correction and correctional facilities in as little time as possible while maintaining economy of construction, the deputy commissioner of capital planning and operations, with respect to the projects authorized by sections one and three to seven, inclusive, may after consultation with the director of the office of project management, the commissioner of correction, the secretary, and such other persons as said deputy commissioner deems appropriate, recommend to the general court, in accordance with the provisions of this section, alternative methods for procurement of design and construction services, including, but not limited to, construction management, fast-tracked or phased construction, turnkey procurement, design and build procurement, lease-purchase of facilities, the utilization of modular buildings, and the utilization of inmate work crews.

In making a recommendation to the general court, said deputy commissioner shall, as to each project for which an alternative method is recommended, set forth in full the procedures by which design and construction services for that project would be procured; provided, however, that a study shall be completed pursuant to section seven K of chapter twenty-nine of the General Laws prior to contracting for any services for the design or construction of such project; and provided, further, that such recommended procedures shall provide for an open competition for design and construction publicly advertised pursuant to paragraph one of section forty-four J of chapter one hundred and forty-nine of the General Laws. Said deputy commissioner shall file with his recommendation a report to the general court specifying his reasons for determining that such recommended alternative method is necessary and feasible and setting

forth a comparison of costs, time schedules, and quality of construction between the recommended alternative and the procurement procedures that will apply if the alternative method is not approved.

Said deputy commissioner shall file his recommendation and report with the inspector general at least fifteen days before said deputy commissioner files said recommendation and report with the general court. The inspector general shall review the recommendation and report with respect to the prevention of fraud, waste and abuse and shall make such comments as said inspector general deems warranted. At the request of said inspector general, said deputy commissioner shall annex the comments of said inspector general to the report of said deputy commissioner to the general court.

Said deputy commissioner shall file his recommendation and report, together with the comments, if any, of the inspector general with the clerks of the senate and the house of representatives, the senate and house committees on ways and means, the joint committee on human services and elderly affairs, and the joint committee on state administration.

SECTION 11. To meet the expenditures necessary to carrying out the provisions of sections five to seven, inclusive, the state treasurer, upon request of the governor, shall issue and sell bonds of the commonwealth, in an amount to be specified by the governor from time to time, not exceeding in the aggregate, the sum of eighty-nine million two hundred fifty thousand dollars. All bonds issued by the commonwealth, as aforesaid, shall be designated on their face, Correction Loan Act of 1986, and shall be issued for such maximum term of years, not exceeding twenty years, as the governor may recommend to the general court pursuant to Section 3 of Article LXII of the Amendments to the Constitution of the Commonwealth; provided, however, that all such bonds shall be payable not later than June thirtieth, two thousand and sixteen. Notwithstanding any other provision of this act, bonds and interest thereon issued under the authority of this section shall be general obligations of the commonwealth.

SECTION 12. To meet the expenditures necessary to carrying out the provisions of sections one, three, and four the state treasurer, upon request of the governor, shall issue and sell bonds of the commonwealth, in an amount to be specified by the governor from time to time, not exceeding in the aggregate, the sum of one hundred twenty-three million, seven hundred fifty thousand dollars. All bonds issued by the commonwealth, as aforesaid, shall be

designated on their face, County Correction Loan Act of 1986, and shall be issued for such maximum term of years, not exceeding twenty years, as the governor may recommend to the general court pursuant to Section 3 of Article LXII of the Amendments to the Constitution of the Commonwealth; provided, however, that all such bonds shall be payable not later than June thirtieth, two thousand and sixteen. Notwithstanding any other provision of this act, bonds and interest thereon issued under the authority of this section shall be general obligations of the commonwealth.

SECTION 13. The state treasurer may borrow from time to time on the credit of the commonwealth such sums of money as may be necessary for the purposes of meeting payments as authorized by this act, and may issue and renew from time to time notes of the commonwealth thereof, bearing interest payable at such time and at such rate as shall be fixed by the state treasurer. Such notes shall be issued and may be renewed one or more times for such term, not exceeding one year, as the governor may recommend to the General Court in accordance with Section 3 of Article LXII of the Amendments to the Constitution of the Commonwealth, but the final maturities of such notes, whether original or renewal, shall not be later than June thirtieth, nineteen hundred and ninety-six. Notwithstanding any other provisions of this act, notes and the interest thereon issued under the authority of this act, shall be general obligations of the commonwealth.

SECTION 14. This act shall take effect upon its passage.

House of Representatives, December 16, 1986.

Preamble adopted, George Keverian, Speaker.

In Senate, December 16, 1986.

Preamble adopted, William M. Bulger, President.

House of Representatives, December 16 , 1986.

Bill passed to be enacted, George Keverian , Speaker.

In Senate, December 16 , 1986.

Bill passed to be enacted, William M. Bulger , President.

December 29 , 1986.

Approved,

at Ten o'clock and 45 minutes, A. M.

Michael S. Dukakis Governor.

WATER RESOURCES AUTHORITY
MASSACHUSETTS